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REVISION
of
NORTH-AMERICAN SPECIES
of
ASTRAGALUS

by
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PREFACE.

In presenting this monograph of the most difficult genus of North American plants I have no excuse to offer, though many could be made. I know its shortcomings better than anyone else can know. There are Mexican species and a few others of which I would like to know more, but to wait till we know all about all species would mean never publishing at all. I have tried to study every species in the field to get my knowledge first hand. I have used every means possible to get and keep fresh material for study. For the most part four per cent formaline has been the killer and preservative of section material as it causes the least shrinkage and distortion of tissue, but it is impossible to preserve any material in anything that will not cause some shrinkage. The celloidin method of infiltration and imbedding has proven the method of most service. Some tissues have been stained but for the most part sections have been left unstained and drawn from just as they are in order to get all details. The method of drawing sections has been to mount sections and to project the images on the paper through a camera which magnifies them three times and to trace the image on the drawing paper with a pencil and when all details are complete to retrace them in ink. Most of the pods, leaves and flowers were drawn by the use of proportional dividers, a few were drawn towards the last by the camera method.

I had done a considerable amount of work on the genus previous to 1894, but the publication of the abortive list of Sheldon in 1894 convinced me that no one but a field botanist could ever monograph the genus right, and for that reason I notified the young man that whatever work he did on the genus would not deter me from finally monographing it.

In getting my material and observations I have traversed the Continent twice east and west and examined nearly all types in this country, and have gone from Central Mexico to the British line several times and have collected a large amount of material, in the twenty-five years that this monograph has been in preparation.

I am indebted to nearly every North American Botanist for specimens loaned or notes taken. Those to whom I am most indebted are the Brandegees for the loan of all their material and for many notes and specimens through the years past. Miss Alice Eastwood loaned me all the material of the California Academy of Science

before it was burned. Prof. Trelease loaned me all the Missouri Botanic Garden Astragali. I have gone over all the material of the Gray Herbarium and photographed all the types through the kindness of Dr. Robinson. I examined the types of the Philadelphia Academy of Science by permission of Thomas Meehan; of Columbia College through Prof. Underwood. While at Washington I worked up all the material of the National Herbarium, and since then have received much material from Dr. Rose and Mr. Maxon. I have been in constant correspondence with Mr. S. B. Parish through the years and have received critical material from him. The same is true of W. C. Cusick. To Prof. Beattie I am indebted for an investigation of the Washington material. To Prof. Hall of the University of California for their material, to F. H. Hillman for Nevada material, to the Agricultural College of Montana and the State University collections, to A. Nelson for a few specimens of Wyoming Astragali, to Mr. Osterhout of Colorado for material, to Mr. Ruth of Texas, to the University of Colorado for material, to Prof. Thornber of the University of Arizona, to Prof. Wooton of New Mexico, to Mrs. R. M. Austin and Mrs. Clemens for all her material, and to many others I am indebted. My friend I. E. Diehl has gone over much of the MS. and checked it up with herbarium material catching up occasional slips. The drawings are the work of Miss Clara Brooks for the most part. A few have been made by my daughter Mildred and a few by myself; particularly cross sections of fresh material. All drawings are natural size unless otherwise stated. Most of the cross sections of fresh material were preserved in formaline infiltrated with celloidin and stained on the slide with picro-carmin, dehydrated with various alcohols and xylol and mounted in Canada balsam.

TERMS USED IN ASTRAGALUS.

The flowers consist of banner which is the upper petal; wings (the two side petals), and keel which is the inner petal and is composed of two petals united along the lower edge. The banner is almost always grooved up the middle which is called the groove or sulcus. The middle of the banner usually has a white spot which is variously shaped and veined. The claws of the petals are those parts inclosed in the calyx and differ from the expanded parts called the blades. When not otherwise stated the claw is not included in measurements of the length of the petals but is included in the length of the flowers. The wings are always narrow and for the most part are concave or convex to the keel and rarely united to its base, the tips mostly are longer than the keel and one or both either flaring or hooked over the end, sometimes one flares and the other is bent over the keel, sometimes they are twisted from a vertical to a horizontal position at the end of keel and then resemble wings, they are mostly entire, but sometimes notched below the middle or rarely cleft or lobed in the forms approaching *Oxytropis*. The keel tip is mostly triangular and inclined to boat-shaped or lunate (moon-shaped), sometimes produced sharply on the upper end, but not in the middle of the end which is a character of *Oxytropis*. The calyx varies from tapering at base to truncate or very oblique and even with a knob on the upper corner, sometimes fleshy-thickened at tip of pedicel, the upper-side is often deeper cleft than the lower. The pods are formed of two valves united by their edges called sutures, the upper edge is the ventral (the one that bears the seed) and is sometimes inverted by the twisting of the pedicel, the lower is the dorsal and is mostly a mere line. The lowest developed forms like *A. campestris* have the simple vetch-like pods with both sutures mere ribs or lines, others have the ventral suture variously thickened and often raised like a keel, it is seldom depressed except in some *Inflati* where it is both depressed and even produced somewhat as a partition from which the seeds hang. When the pod is grooved at all it is mostly along the dorsal suture which is variously impressed forming a fold, in some forms this fold extends to the ventral suture simply as a fold, at other times its sides are united to form a partition which rarely is completely united to the ventral suture and making the pod wholly 2-celled, very rarely does it lose its identity as a union of the two sides of the fold; when the pod is grooved it is called sulcate. It is called inflated when the cavity is larger than the mature seeds. When the pod has a stalk on which it is raised partly or wholly out of the calyx this is called the stipe. The cross-section of the pod as to shape is supposed to rest on the dorsal as its base. The seeds of the *Astragali* differ but little and are reniform and attached along the ventral suture, generally attached along the middle of the pod and not from base to tip.

MORPHOLOGY.

The flowers of *Astragalus* are papilionaceous; the calyx tubular; the stamens united below; and the petals five and clawed. The upper petal is the banner with a conspicuously expanded blade creased in the middle lengthwise, generally with a white spot in the middle, and with sides and tip variously reflexed, or tip often hooded and always notched. The two lateral petals are the wings and are nearly always very oblique and mostly narrow, eared at base of blade where they are inset in corresponding depressions in the keel blades. The wing blades are parallel with the keel and one or the other or both flare at tip, and are generally a little longer than the keel and shorter than the banner, frequently the tips are incurved over the keel tip, the sides are flat, convex, or concave to the keel. The tip always has a rudimentary or more evident notch near the middle of the end. This notch rarely extends deep enough to make lobes as in *Oxytropis*, and only in *A. calycosus* is there a long hair-like tongue extending from the notch as a third lobe. The two lower petals are in their blades united along the lower edge forming a boat-shaped keel which inclose the stamens. This is variously pointed and colored but rarely is extended into a beak.

The fruit is a normally single-celled pod, formed by a single carpel leaf joined by the edges, the seeds being borne on the tips of the carpel veins. The ventral suture corresponds to the junction line of the edges of the leaf, the dorsal suture to the midrib of the leaf. The ventral edges are loosely united and always separate at maturity. As a rule the seed-bearing line is thickened, and only in the *Homalobi* is it thin and nerve-like. The thicker is the wall of the pod the thicker is the suture, becoming sometimes 2 mm. thick. In the *Inflati* it is produced inwards as a thin wing along the middle, and in other groups is often a thickened ridge within and often raised and thickened or winged without. In addition the pod is mostly variously grooved or sulcate along one or both sutures. The dorsal suture rarely splits at maturity, but in the *Homalobi* the pod mostly falls off into two curling valves. In *A. lonchocarpus* the pod at last flattens into a perfect leaf. In the *Podo-sclerocarpi* the pod tends to split at both sutures at the base. In the *Sarcocarpi* and *Argophylli* the ventral suture opens a very little, often not enough for the seeds to fall out and the pod becomes long after maturity, as in the *Inflati* a papery ball blown far by the wind. There are all degrees of differentiation in the dorsal suture from a mere line in the *Inflati* and simpler forms to a dorsal groove without thickening, to a raised line or thin wing as in the *Alpini* without being double, then passing into a simple double fold in the wall with or without united sides, and then into a special partition complete or nearly so which is clearly double on dissection as is seen so well in the *Sarcocarpi*, and *A. lentiginosus*.

On the character of the pods and flowers hang most of the species, combined with vegetative characters, many species much alike in pods differ in foliage and habit.

PUBESCENCE.

The pubescence of *Astragalus* is almost always present as straight, short and appressed hairs, round in cross section, and tapering to tip. That on the calyx is normally longer and looser than on the leaves. The banner is rarely a little hairy at tip.

Astragalus inflexus, *Utahensis*, *funereus* and *coccineus* and forms of *Purshii* have very delicate kinked hairs variously matted. The *Mollissimi* usually have matted hairs on the pods, but those on the leaves though very dense are rarely matted.

Among the *Argophylli* the pubescence is mostly dense and straight. In *A. amphioxys* the hairs are flat, echinate, tapering toward both ends and fixed at or near the middle. This is also true of *A. calycosus*, the *Uliginosi*, *nitidus*. Very rarely do the hairs have a pustulate base.

In *A. lentiginosus* the pubescence is very variable. One variety has flat and very short broad hairs closely appressed and fixed by the base. Other varieties have the pubescence almost woolly as in *Fremonti*, *nigricalycis*, etc. *A. macrodon* has much the same pubescence. The same is true in the hot climate *Inflatii* along the Coast of California, some species have woolly pubescence, others silvery but not woolly.

No species have lepidote or stellate hairs. There is a complete transition in the hairs from normal to pick-shaped. About the only valuable character distinguishing *A. Shortianus* from *A. amphioxys* is the pubescence which in the former is of slender hairs fixed by the base, and in the other flat hairs fixed by the middle and wide and echinate, but this varies in the species from a flat hair with a mere knob on one side at the base to one fixed by the middle.

There is very little special development of hair as root protection except in *A. triphyllus*, *sericoleucus*, *simplicifolius*, *Gilensis*, and in these there is more development of stipules.

ASTRAGALUS.

Tourn. in L. Gen. 215 (1837). Sp. Pl. 755. (1753). *Cystium* Stev., *Hamosa* Medic., *Homalobus* Nutt., *Hypoglottis* Fourr., *Onix* Spiesia and *Aragallus* Necker never had any species described with them till the recognized genera were published with species. *Astragalus* was first published by Tournefort without species, then by Linnæus in his *Genera*, *Phaca* preceding it and having its first publication in the *Genera* as an equivalent of *Astragaloides* Tournefort. Linnæus recognizing Tournefort as the author of *Astragalus*. The same order of genera was retained in the *Species Plantarum*, Linnæus regarding both genera as having been previously published. The botanical world is therefore justified in retaining *Astragalus* on the merging of *Phaca* with it.

Calyx 5-toothed. Petals with claws, 5, the upper the banner and broader than the rest and mostly arcuate and with reflexed sides, the center occupied by a deep groove or sulcus running lengthwise, at or near the center when the banner is colored is a variable white spot, the tip mostly notched. On each side, a little below the banner, are the two wings which are narrowly eared below and more or less adhering to the keel and variably oblique, entire or only notched, mostly longer than the keel and shorter than the banner. The keel is formed by the two lower petals adhering by their lower edges to the tip like the keel of a boat in general appearance and very oblique, and inclosing the stamens and pistil. Stamen 10, diadelphous, 9 and 1. Pistil simple and mostly 1-celled. Stigma terminal, minute. Fruit a pod seed-bearing along the upper suture. Seeds on slender stalks, reniform. Texture of pods from fleshy to papery, the cavity generally larger than the seeds. Herbs or rarely a little shrubby below. Leaves with odd-pinnate leaflets (reduced to the simple leaf-like rachis in *A. simplicifolius*, and to a single, large, leathery, jointed leaflet in *A. Asclepiadoides*). Distinguished from *Oxytropis* by the keel tip not being abruptly turned out in a sharp beak or when this is true then the wings are not greatly lobed as in *Oxytropis*. Distinguished from *Crotalaria* by the diadelphous stamens and flowers never truly yellow.

A genus of about 1500 species growing in all the life zones. It contains a toxic alkaloid or glucoside which causes derangement of the brain functions and affecting the motor nerves when fresh. The early species like *A. mollissimus*, *lentiginosus* and others, which come out before the grass is grown enough to eat, often poison horses. Sheep are sometimes killed by *Canadensis* in summer in the same way when other forage is eaten out so that they have to feed on this, but no stock naturally eat any species of *Astragalus*.

SYSTEMS OF CLASSIFICATION.

Many attempts have been made to segregate the genus into subgenera, but all efforts have been abortive for the reason that the species are too closely related to make any such arrangement satisfactory. The attempt to segregate the species into several genera has been still more abortive. *Oxytropis* can be kept out on the flimsiest of characters only.

DeCANDOLLE'S REVISION.

DeCandolle in the *Prodromus* pp. 281-307 attempts to arrange the World's species under four general classes according to the color of the flowers and the presence of spines. His first class is the **Purpurascetes** with free stipules and purple flowers. His sub-groups under this are the **Hypoglottidei** with 23 species, the **Dissitiflori** with 41 species **Onybrychoidei** with 35 species, **Sesamei** with 8 species, **Vesicarli** with 4 species, **Annulares** with 10 species.

His second class is the **Ochroleuci** with free stipules and cream-colored flowers. His sub-groups are **Bucerates** with 11 species, **Synochreati** with 10 species, **Ciceroidei** with 20 species, **Galegiformes** with 4 species **Alopecuroidei** with 8 species, **Christiani** with 5 species.

His third class is the **Tragacanthacei** with adnate stipules and 38 species and the **Chronopodii** with 2 species.

His fourth class is the **Podochreati** with adnate stipules, and spinescent or persistent petioles. This contains the **Tragacanthae** with petioles not indurate nor spinescent. This contains the **Anthophylloidei** with 14 species, the **Caprini** with 22 species, the **Incani** with 12 species and the **Radiciflori** with 11 species.

We are not concerned with his last two classes as none of the species are North American.

His **Ochroleuci** contains the **Galegiformes** with our *A. racemosus* and is characterized by the free stipules, cream-colored flowers and stipitate pods. This class also contains the **Ciceroidei** with our *A. strigulosus*, *glaber* and *Canadensis*. Its character is free stipules, peduncled spikes, cream-colored flowers, perennials, sessile pods. Now *A. strigulosus* has stipitate pods and often purple flowers and with intruded septum. *A. Canadensis* has 2-celled pods fleshy and with peculiar flowers. *A. glaber* has 1-celled pods and long and distant racemes. The plants are not at all related. His **Synochreati** contains *A. reptans* which is related to *A. strigulosus* and has connate stipules and light-colored flowers and papery pods. His **Bucerates** contains no North American species, but *A. hamosus* is like many of our *Hamosi*. The group character is curved pods, free stipules, cream-colored flowers, and annual plants, but our flowers are as often purple as not, stipules often united, and roots often perennial.

His **Purpurascetes** Class has *A. Nuttallianus* in the **Annulares** and its character is annual roots, free stipules curved pods, variable flowers but supposed to be purple. The pods of *Nuttallianus* are often

almost straight but the general characters of its group are not given. His *Vesicarii* contains no North American species. The chief character is inflated calyx. Our *A. oocalycis* could be placed there. His *Sesamei* contains no North American species. His *Onobrychoidei* contains such wholly diverse species as *A. caryocarpus* (*crassicarpus*), *Missouriensis*, *Labradoricus*, *adsurgens* (*nitidus*), which belong to at least three distinct groups. His *Dissitiflori* contains only *A. gracilis*. His *Hypoglottidei* contains *A. bidentatus* and *Hypoglottis* (*agrestis*) which species are not at all related.

From this it is evident that no conception of North American relationship in the genus was in the mind of DeCandolle.

Phaca was kept up by him to contain such diverse species as *A. alpinus*, *triflorus*, *villosus*, *caespitosus*, *mollis*, the *Inflati*, *andinus*, etc.

The only other serious attempt at classification worthy of mention is that of Torrey and Gray in their *Flora of North America*, but they only copied DeCandolle. Hooker in his *Flora* did the same.

GRAY'S REVISION.

Dr. Asa Gray in *Proc. Am. Acad.* 6 1864 made the first real attempt at proper classification of the genus as to North America. In 1871 Watson, profiting by a year's field work in the West, amplified it somewhat and corrected some details but for the most part followed Gray. This was also the first attempt to group the species genetically starting according to Gray's universal rule from the most developed and going to the least altered species.

Gray's system was based on the fundamental idea of one and two-celled pods as separating the two series *Astragalus* proper and *Phaca*. *Astragalus* was the more developed because of being 2-celled and was based on the greater intrusion of the dorsal suture if the pods were not fully 2-celled. *Phaca* was unfortunately based on the sutures being not at all intruded or the ventral the more produced. Had he made three series, one to contain *Astragalus* proper, the other *Phaca* as defined by Linnaeus in his species of the *Sp. Pl.* and represented by *A. alpinus* (*Phaca alpina*) to contain those with the ventral suture the most intruded, and the third series which we may call *Homalobus* with nerve-like sutures not at all intruded he would have had a set of series which could not be improved upon, but I do not think anything is gained by attempting to separate the genus into three series.

Under *Astragalus* proper we find him making 16 sections. His supposedly most developed species were the *Sarcocarpi* because of the fleshy and fully 2-celled pods. His emphasis of the 2-celled feature prevented him from seeing that this group is manifestly close to the *Argophylli* which he puts last in his series and some of whose species he put in *Phaca* (*A. inflexus*, *Purshii* and *Utahensis*). In addition this group is not as highly developed as the *Didymocarpi* and *Micranthi* which he places below it.

His next group is the *Diphysi* containing *A. lentiginosus* which is far removed from the rest of the *Inflati* to which it is related but which nevertheless connects the *Inflati* with the *Sarcocarpi*.

His third group is the *Chaetodontes* containing *Spaldingii* and *Lyallii* but he seems to have failed to have recognized its close relationship to the *Didymocarpi*, *Micranthi* and *Reflexi* which are the most developed groups in the genus. To this we now add *A. Brauntoni*.

His fourth section is the *Mollissimi* which is wholly out of place, being next to the *Argophylli*.

His fifth section is the *Uliginosi*, the *Ciceroidei* of DeCandolle, a well defined group containing *A. Canadensis* and *Mortoni*, and should

have had also *A. Oreganus*, *terminalis*, and *A. Cooperi* (*neglectus*) which later he curiously places in *Phaca*. The allied species *A. arrectus*, *conjunctus*, etc. had not then been discovered. This group is evidently allied to the *Sarcocarpi*.

His sixth section is **Onobrychoides**, the *Onobrychoidei* of DeCandolle. It contains *A. adsurgens* (*nitidus*) and *Hypoglottis* (*agrestis*) two very distinct and little related species but which are closer together than to any other group, and which are probably nearer to the *Chaetodontes*.

His seventh section should have been his first, the **Reflexi** and should not have been separated from the *Didymocarpi* to which its single species *A. reflexus* belongs along with *A. Brazoensis*.

The eighth section is the **Didymocarpi**, and ninth the **Micranthi** showing that Gray had probably worked out the relationship of these plants.

The tenth section (and following sections) takes up another wholly different set of species, of lower development for the most part.

Section eleven is the **Succumbentes**, with the one species *A. succumbens*, a class by itself. This may have some relationship with the *Galegiformes* which he places next but I think is much nearer the *Malaci*.

Next comes the **Galegiformes** two species which seem so radically distinct and yet cannot be separated or placed anywhere else to better advantage, *A. Drummondii* and *racemosus*. To this we now add *A. scopulorum*. This group is well placed next to the *Ocreati*, but Gray should have placed it in *Phaca*. The *Galegiformes* contains also *A. cyrtoides* (*A. Gibbsii*), Gray guessing from the flowers that it might belong here, but the guess was a poor one as it belongs elsewhere.

The **Ocreati**, section eleven, contains three very diverse species. *A. flavus* is wholly 1-celled, as are the other species we now add to it. So is *A. humistratus* which belongs elsewhere. The other species *A. Oreganus* belongs with *A. Canadensis*. This group is very closely allied to the *Bisulcati* which Gray places rightly in the *Phaca* series. This group should also have contained *A. gracilis* and *microlobus* which he puts in section 13 and calls the *Microlobi*.

The next section the **Oroboidei** is a hodge-podge of species, a catchall, and shows haste and little study. The first group in this section containing *A. aboriginum*, *Robbinsii*, *oroboides* (*elegans*) and *alpinus* (*andinus*) belongs to his *Inflati* under *Phaca* and forms a part of my *Alpini*, but Gray had to put them here because of the intrusion of the dorsal suture, which however is not as great as that of the ventral. *A. tener* he also places here, but it belongs among the *Leptocarpi*. In another group in this section he puts *A. Lindheimeri* and *distortus* which belong with the *Leptocarpi* and *Hamosi* in spite of the septum of *distortus* being slight. He places here *A. obcordatus* which belongs with *A. sparsiflorus*, and *A. glaber* which belongs with the group *Hamosi*.

The next class the fifteenth is the **Lotiflori** containing *lotiflorus* and *villosus*, two quite diverse species which have some similarity in flowers only. I think *A. villosus* is nearer the *Sparsiflori* to which I refer *A. obcordatus* and *distortus*, while *A. lotiflorus* which is both an *Astragalus* and *Phaca* according to the intrusion or absence of intrusion of dorsal suture belongs in a group with *A. circumdatus*, *procumbens* (*accumbens*) and *Mohavensis*, species not known then. Both these groups are related to the *Inflati*. Doubtless Gray placed these two species together because they could not be placed elsewhere and had a distant relationship.

The last class of *Astragalus* proper, the sixteenth, is the **Argophylli**. This group Gray was also led to confuse by too much emphasis on the intrusion of the dorsal suture, and by too little knowledge of

the species. *A. pubentissimus* was an obscure plant in his day and remained so till I studied it in the field and collected abundant material of it many years later. We now know that it belongs with the *Inflati*, his *Inflati*, and not at all with the *Argophylli*. He also placed *A. Arthu-Schottii* here, but we now know that this is only a variety of *A. lentiginosus* and also belongs with the *Inflati*. The rest of his *Argophylli* form a well defined group which must be recognized but must be extended to contain some of his *Phaca* group, and whose relationship to his *Argophylli* he clearly saw as is shown by their position next to the *Argophylli*. The *Argophylli* then should contain not only the original species *A. Missouriensis*, *Shortianus*, *Parryi* and *glareosus* (erroneously supposed by Gray to be *A. argophyllus*) but also his *Phaca* species *A. inflexus*, the true *glareosus*, *Purshii* and *Utahensis*. Very close to this group, as we have stated before, is the *Mollissimi*, and various species discovered since Gray's time.

Taking up series 2, **PHACA**, we find it subdivided into 11 groups.

The first group the **Eriocarpi** does not belong in *Phaca* at all as I have stated, but belongs in *Argophylli*.

The second group (Section 18) the **Oocarpi** contains *A. Cooperi* (*neglectus*) and *oocarpus*, two quite diverse species. The first belongs with *A. Canadensis* as I have stated and is an *Astragalus*, and the second belongs in the *Inflati*. *A. Preussii* he places in the **Scytocarpi** and which group is next of kin to the **Scytocarpi** on the one hand and the *Inflati* on the other.

The third group (section 19) is the *Inflati*, a well defined group but contains *A. frigidus* (*alpinus*) which as I have shown belongs in his *Astragalus* along with *A. aboriginum* in a group which I have named the **Alpini**.

The fourth group (Section 20) is the **Lonchocarpi** with one species *A. lonchocarpus* which is an *Astragalus* and not a *Phaca*, having the ventral suture not at all produced and belongs next to the *Galegiformes*.

His fifth group (Section 21) is the **Microcystei**, all of whose species belong in the *Inflati*.

The sixth group is the **Bisulcati** to which he refers *A. Beckwithii* and *bisulcatus*, two species not at all related. He might much better have referred *A. Beckwithii* to the **Sclerocarpi** which it resembles in many ways, but extensive field work has shown that it is closest related to *A. oophorus* which belongs to the *Inflati* of Gray but connecting with the **Preussii**. *A. bisulcatus* is so closely related to the **Ocreati** that it hardly deserves a separate grouping.

His seventh (Section 23) group is the **Pectinati** containing *A. pectinatus* only, but which I think is better placed among the **Podosclerocarpi**.

His eighth group is the **Scytocarpi**, another botanical catchall of no merit. Its species are nine. *A. Preussii* belongs with the **Preussii**, *A. Chamaeleuce* (*pygmaeus*) with the *Argophylli* as also does *A. tephrodes*. *A. aridus* belongs in his *Inflati*. *A. Sonorae* belongs with the **Homalobi**. *A. gracilentus*, *Hallii*, *Fendleri*, and *flexuosus* belong together in a group I have called the **Flexuosi**, and which ranks lowest in the genus along with the **Homalobi**.

His ninth group (Section 25) is the **Podosclerocarpi** containing *A. sclerocarpus* and *speirocarpus*, which I think belong in separate groups, *A. sclerocarpus* represents a well developed group of desert plants containing his **Pectinati**, Watson's **Pterocarpi**, and several other species. *A. speirocarpus* belongs with *A. collinus* and *Gibbsii*. *Tweedyi*, *Alvordensis*, and *porrectus* in a separate group which I have called the **Collini** and which is nearest related to the **Flexuosi** on the one hand and the **Podosclerocarpi** on the other.

His tenth group (Section 26) is the **Homalobi** which he pretty clearly defines, though I would place *A. collinus* in a separate group.

As I have already stated I think the Homalobi should form the third Series. It is the lowest group in the genus and next of kin to Hosackia, Lathyrus and Vicia.

His last group (Section 27) is the Trlphylli, related to the Homalobi but higher than it, containing *A. triphyllus* and *sericoleucus*. I think it is an error to place the latter species with it for it belongs with the Homalobi along with *A. simplicifolius*.

Gray makes a third Series containing *A. nothoxys*, an oxytropidoid form which I think belongs better with the Leptocarpi. He evidently had not as yet worked out the other oxytropidoid species *A. Arizonicus* and *calycosus* which I place among the Hamosi.

WATSON'S REVISION.

The next attempt at revising the genus is that of Watson in the Appendix of King's Report. His is an amplification of Gray's work as stated at its beginning.

He corrects some of Gray's errors, and makes a few of his own, but in the main it is an admirable revision of this excellent work. It is easy enough to criticise the work of earlier botanists who had little or no field experience and scanty and poor material, but very few of us would have done as well.

He puts *A. Coulteri* (*Arthu-schottii*) where it belongs, with the *Diphysi* (*Inflati*) and also puts *A. platytropis* with it where it does not belong. He keeps all of Gray's sections in Gray's order.

He adds *A. calycosus* to the *Chaetodontes*, a natural error, but it belongs far removed in the Hamosi according to Gray's order but in fact not so far removed in relationship.

He puts *A. Arizonicus* with the *Leptocarpi* where it does not belong but keeps them in the *Micranthi*. To this group he adds a subsection of "anomalous species" containing *A. Andersoni*, *malacus*, *Bolanderi*, *arrectus*, *atratus*, *obscurus* and *tener*, another hodge-podge. *A. malacus* belongs near the *Argophylli*, *A. Andersoni* with the Hamosi, *A. Bolanderi* and *arrectus* with the *Reventi-arrecti*, *A. atratus* and *obscurus* with the *Atrati*, *A. tener* with the *Leptocarpi*.

He keeps *A. humistratus* among the *Ocreati* to which it is related but belongs better with the Homalobi.

He keeps the *Alpini* and *Sparsiflori* together under *Oroboidei* and adds *A. Breweri* which belongs with the *Didymocarpi*; and *A. Lindheimeri*, *distortus* and *glaber* he puts here though better placed among the *Leptocarpi* and Hamosi.

He adds the section *Pterocarpi* which is better placed among the *Podo-sclerocarpi*.

He transfers *A. Beckwithii* from the *Bisulcati* to the *Argophylli* which is also an error. He makes no improvement on the *Argophylli*.

He adds *A. nudus* (*Serenoi*) to the *Pectinati*, wisely, but does not add that to the *Podo-sclerocarpi* where it belongs.

There is no improvement on the *Scytocarpi*. He puts *A. psychnostachyus* here when it belongs along with *A. Palmeri* among the *Inflati* near *A. Hornii*.

He puts *A. cyrtoides* (*Gibbsii*) in the *Podo-sclerocarpi*, but it is better placed next to *A. collinus* in the *Collini*.

He puts *A. porrectus* among the Homalobi, a natural error, but I think is better placed in the *Collini*. He puts *A. Palmeri* in the Homalobi, but it is better placed among the *Inflati*.

The revision of the genus in the *Pflanzen-familien* is simply a copy of the work of Gray and Watson.

SHELDON'S PRELIMINARY LIST.

This list which should never have been printed was published to get the credit of many new names made necessary by the Brittonian Code which he followed, and without the exhaustive study that a revision would entail. There was no original work worth mention in it, here and there divisions indicated by Watson were created, and here and there changes made, which I will mention.

The anomalous species, oxtropidoid, he calls Section I Spiesioides and puts *A. acutirostris* and *nothoxys* in it, while they belong to separate sections.

Homalobus still contains *A. collinus* and *porrectus* which belong in the *Collini* *A. miser* which belongs in the *Inflati* of Gray, *A. debilis* (*Bodini*) which belongs in the *Debiles* and close to the *Alpini* which Gray would have placed in *Phaca* probably.

A. speirocarpus is still kept in the *Podo-sclerocarpi*.

A. griseopubens (*campestris*) is put in a new section "Famelicus," a botanical hodge-podge, instead of in the *Homalobi* where it belongs, *A. scalaris* is put here while it belongs with the *Inflati*. *A. debilis* is put here while it belongs with the *Debiles*. *A. sabulosus*, *limatus*, *prælongus* (*Pattersoni*) are put here while they belong with the *Preussii*. *A. reventus* is put here while it belongs in the *Reventi-arrecti*. It also contains *A. flexuosus*, *Hallii*, *gracilentus*, etc. It contains *A. aridus* which belongs with the *Inflati*. *A. Sonoræ* (*humistratus*) is here but belongs with the *Homalobi*. *A. psych-nostachyus* is here but belongs in the *Inflati*. *A. troglodytus* is here but I would have placed it in the *Ocreati*. *A. Virgineus* (*sabulonum*) is here but belongs in the *Inflati*. *A. castanæformis* is here but belongs in the *Argophylli*, so also *tephrodes*, *Newberryi* and *Cham-æleuce*. *A. Eastwoodæ* (*Preussii*) is here but belongs in the *Preussii*.

He renames the *Lonchocarpi* as *Clavocarpus*.

He puts *A. desperatus* in the *Inflati*, but it belongs in the *Argophylli*. He puts *A. ampullarius* here, but it belongs in the *Preussii*. He puts *A. oocarpus* here but it belongs in the *Inflati*.

He makes a new section *Araneocarpus* and puts *A. neglectus* in it instead of in the *Uliginosi* where it belongs. He puts *A. Texanus* (*giganteus*) here when it belongs in the *Mollissimi*.

He makes another new section *Lanocarpus* to hold the *Purshii* group which belongs in the *Argophylli*. All the above he puts in the general Series *Phaca*.

His *Euastragalus*, corresponding to *Astragalus* proper of Gray he divides up variously. His first section being *Sericophyllus* containing another hodge-podge of species. *A. glareosus*, *pephragmenus*, *Parryi*, *amphioxys*, *Shortianus*, *Missouriensis*, *cibarius* belongs in the *Argophylli*. *A. triquetrus* belongs in the *Inflati* as does also *A. pubentissimus*, *Mokiensis*, etc. *A. Casei* belongs in the *Podo-sclerocarpi*. *A. Reverchoni* belongs in the *Lotiflori*. *A. Gilensis* belongs in the *Homalobi*. *A. Beckwithii* belongs in the *Preussii*.

He renames Watson's *Pterocarpi* as *Scaticarpi*.

He still keeps *A. villosus* in the *Lotiflori*.

He still more befuddles the *Oroboidei*. He puts *A. glaber* and *distortus* (*Englemanni*) here, when they belong elsewhere. *A. palans* is put here when it belongs in the *Inflati*. *A. obcordatus* is put here but belongs in the *Sparsiflori*. *A. Sileranus* is put here but belongs in the *Flexuosi*. *A. Lindheimeri* is put here but belongs in the *Leptocarpi*. He puts *A. lentiformis* and *Lemmoni* here when they belong in the *Micranthi*. He puts *A. Breweri* here when it belongs in the *Didymocarpi*. He puts *A. Ibapensis* here when it belongs in the *Atrati*. He puts *A. Dodgeanus* here when it belongs in the *Homalobi*.

He puts *A. sparsiflorus* here when it belongs in the Sparsiflori.

He renames Gray's Section Microlobi and calls it Rugocarpus. belongs in the Lotiflori along with Mohavensis. He puts *A. humi-*

In the Ocreati he puts *A. accumbens* (procumbens) when it stratus here when it is better placed in the Momalobi.

The Galigformes he renames but puts *A. atropubescens* in it when it belongs in the Reventi-arrecti. He puts *A. Howelli* and *misellus* here when they belong in the Hamosi.

He makes a new section for *A. asclepiadoides* and calls it Asclepiadodes, ignoring the fact that I had previously suggested the name *Pachyphyllus* for the section, but the species is better placed in the Preussii.

He creates a new section and calls it Eremiticus. This is another hodge-podge of species. It contains *A. diphacus* which belongs in the Didymocarpi. *A. tener* which belongs in the Leptocarpi. *A. obscurus* which belongs in the Atrati. *A. Panamintensis* also belongs in the Atrati. *A. recurvus* belongs in the Strigulosi. *A. pachypus* which belongs in the Sclerocarpi. *A. sylvaticus* which belongs in the Hamosi. *A. tricarinatus* which belongs in the Hamosi. *A. arrectus* which belongs in the Reventi-arrecti. *A. Brandegii* which belongs in the Strigulosi. *A. drepanolobus* which goes in the Hamosi. *A. Bolanderi* which belongs in the Reventi-arrecti. *A. malacus* which goes in the Malaci. *A. Andersoni*, *Congdoni* and *Orcuttianus* which go in the Hamosi. *A. Rusbyi* which belongs in the Strigulosi. *A. Arizonicus* which belongs in the Hamosi. *A. leptocarpus*, *streptopus* (*acutirostis*) *Nuttallianus*, *Wrightii* all of which belong in the Leptocarpi. *A. albus* which goes in the Hamosi. *A. Daleæ* (*vaccarum*) which goes in the Micranthi. *A. -Cobrensis* which goes with the Strigulosi. *A. hypoxylus*, *Pringlei*, *Hartwegi* and *vaccarum* which belong in the Micranthi.

He again creates a new name for an old section, the Didymocarpi, calling it Dispermus.

Under the Hypoglottidei which he renames Hypoglottidens he puts *A. venterum* (*Oreganus*) and the *terminalis* which belongs in the Uliginosi.

Under the Uliginosi he puts *A. ervoiles* which neither he nor anyone else knows anything about. He also places *A. accidens* here which belongs in the Reventi-arrecti. ..

Under the Mollissimi he puts *A. Laynæ* which belongs with the Malaci.

Under the Chætodontes he follows Watson in keeping *A. calycosus* there but which belongs in the Hamosi, and which he would have placed in his Spiesiodes, if he had known anything about the species along with *A. Arizonicus*.

Under the Lentiginosi he puts *A. Bajænsis* (*Hornii*) which belongs in the Inflati.

He again makes a new name for an old section the Sarocarp by calling it Carnoscocarpus.

At the end he has 27 unplaced species.

The list shows no conception of genetic relationship other than that indicated by his predecessors, and a continual blundering in the placing of new species, as well as a disregard for priority in the naming of sections, which is wholly unexcusable.

GENERIC SEGREGATION.

The conception of *Astragalus* as a genus began with Tournefort if not earlier. Since his time some sixty genera have been proposed as segregates from it. Tournefort himself separated Phacandra under the name of *Astragaloides*, and Linnæus in *Linn Corolli*. Gen.

changed it to *Phaca*. Medic proposed several segregations in 1787. *Glandula*, *Glottis*, *Hamosa*, *Onix*, *Stella*, *Tium* and *Triquetra* *Aragallus* and *Spiesia* were proposed by Necker in 1790 but without description of species. Steudel proposed *Aragus* for the *Aragallus* of Necker in 1840, and *Thium* in 1821. Steven in 1832 proposed *Ammodytes*, *chondrocarpus*, *Cymbicarpus*, *Euprepia*, *Glyciphylla*, *Picraena*, *Proselias*, *Psychridium*, *Rysodium*. In 1856 he again continued the disintegration by proposing *Ailurischia*, *Alopecias*, *Ankylobus*, *Craccina*, *Cystium*, *Euilus*, *Feidanthus*, *Hedyphylla*, *Macrosema*, *Myobroma*, *Pedina*, *Philammos*, *Solenotus*. Torrey and Gray published Nuttall's *Kentrophyta* in 1840 also *Homalobus* Nutt. Walpers put out *Aurosema* in 1842. Boissier proposed *Europhaca* about 1840. Opiz proposed *Kirchnera* in 1858, also *medyphylla*. Royle proposed *Podolanthus* in 1835. Regel & Smalh. Proposed *Didymopelta*, *Sewerzowia*, and *Dipelta* in 1877. *Diplothea* was proposed by Hochst in 1846. *Hamaria* was proposed by Fournier in 1868 and also *Hypoglottis* and *Podochrea*. Rafinesque also earned a place in the segregators by *Physondra* in 1832. Rydberg seems to have failed to note that this genus antedates *Homalobus* by eight years. So we shall see a new batch of synonyms in due time.

Recently Rydberg harking back to the ancient times has resurrected the old genera and methods of segregation so long dead through the good work of Gray and Bentham & Hooker and the *Pflanzenfamilien*. Gray demonstrated conclusively the folly of attempting to segregate the species of *Astragalus* in different genera, and he has been almost universally followed both in this country and abroad. He saw the folly of keeping up the form genera *Kentrophyta* and *Homalobus* as well as *Phaca* which latter had persisted longest. He still adhered to *Oxytropis* which can be kept up only on the flimsiest grounds, that of an abruptly beaked keel, and he should have added enlarged and most lobed wings. A few species of *Astragalus* have an obscure boss at keel tip, and even a rudiment of beak, such as *A. acutirostris* and *nothoxys*, and others have produced keel as in *campestris*, *atratus*, etc. with normal wings, and *A. Arizonicus* with lobed or enlarged wings, and *A. calycosus* with conspicuously lobed wings and blunt keel. But it seems better to follow Gray in still keeping up *Oxytropis* than to merge it in *Astragalus*, for its species as a rule have a general habit somewhat different from *Astragalus* if we exclude the oxytropidoid species, but with them in the genus it must be merged.

Britton & Brown in their *Flora* proposed *Orophaca* in 1897 for the group *Triphylli* of Gray, without recognizing the very diverse character of its members. There might be some reason in keeping up *Orophaca* for *A. triphyllus* alone but to put the *sericoleucus* group with it spoils it, as these plants are manifestly modifications of the *montanus* group.

The proposed genera of Rydberg are mostly the product of his idea that no genus should contain more than six species whatever Nature may have said or done about it, which is rather hard on the Almighty, but where genera and species are governed by botanical inspiration and not study or morphological knowledge this state of affairs make strange bed fellows.

Taking up Rydberg's genera alphabetically we find *Atelophragma* proposed for a part of the *Alpini*. In it are *A. aboriginum*, *Forwoodii* (*aboriginum*) *glabriusculus*, *lineare* (*aboriginum*), *elegans*, *Macounii* (*Labradoricus* var.), *Shearii* (*elegans*). These belong together but he also includes *A. Arthuri* which belongs in the *Hamosi*, and *A. Brandegei* which belongs in the *Strigulosi*, and *A. Ibapensis* which belongs in the *Atrati*. He also omits from the genus the other members of the *Alpini*.

His next genus is *Cnemidophacos*, which contains *A. argillosus*, *confertiflorus*, *flavus*, which naturally belong together (as indicated by Gray under the *Ocreati*) but he omits *A. Moencoppensis* and *sophoroides*, and puts in it *A. terminalis* (*reventoides*) which belongs in the *Uliginosi*, and *A. reventus* which belongs in the *Reventi-arrecti*.

Diholcos is his next genus and includes *A. bisulcatus* and *Haydenianus*, a well marked group, called *Bisulcati* by Gray which like all of Rydberg's other segregations was first recognized by Gray or Watson. As I have indicated this is rather too close to the *Ocreati* for good separation.

His next genus is *Ctenophyllum* and contains *A. Grayi* and *pectinatus* a well marked group but too close for separation from the rest of the *Podosclerocarpi*, and already grouped by Gray under the *Pectinati*.

Cystium Steven is his next genus and is supposed to include Gray's *Diphysi*. It follows Gray in everything even to including *A. platytropis* which belongs in the *Atrati* or near there. He also adds *A. Boiseanus* (*arrectus* var.) which belongs in the *Reventi-arrecti*.

Geoprimum is another segregate to include Gray's *Sarcocarpi*, a well marked group.

Hamosus is another genus of Medic that he takes up. It corresponds with the *Leptocarpi* and not the *Hamosi* of Medic. It contains *A. Nuttallianus*, *leptocarpus*, *Lindheimeri* which form a good group. But he also puts in it *A. calycus* and var., which belong in the *Hamosi* proper. And he puts *A. atratus* here also which belongs in the *Atrati*. He places here *A. atratiformis* (*straturensis*) which belongs in the *Strigulosi*.

The next genus in order is not of Rydberg but Heller and is called *Hesperastragalus* and includes the *Didymocarpi* of Gray but neither Heller nor Rydberg sees that to it also belong *Brazoensis*, *Breweri* and *reflexus*.

Jonesiella is another Rydbergian genus to include the remarkable *A. asclepiadoides* which belongs in the *Preussii*.

Kentrophyta Nutt. is kept up and with the old limitations, but it belongs in the *Homalobi*.

Microphacos is one of his genera to include the *Microlobi* of Gray, but is better placed in the *Flexuosi*, being only depauperate forms of this group.

Onix of Medic is taken up for *A. Mulfordae*, but this belongs in the *Hamosi*.

Homalobus is kept up and is a general hodge-podge of species. Without naming the species which properly belong there and which he puts there we find him blindly following Gray. *A. collinus* and *curvicarpus* (*Gibbsii*) are here but belong in the *Collini*. *A. debilis* belongs in the *Debiles*. *A. Fendleri* and *flexuosus* belong in the *Flexuosi*; *A. grallator* in the *Bisulcati*; *A. Hallii* in the *Flexuosi*; *A. macrocarpus* (*lonchocarpus*) in the *Lonchocarpi*; *A. miser* in the *Inflati*; *A. stenophyllum* in the *Collini*.

The *Phaca* of Linnaeus is another wholly unintelligible mixup, as treated by Rydberg. As I have stated *Phaca* of Linnaeus belongs to the *Alpini*. Rydberg puts *A. ampullarius* in it, but it belongs to the *Preussii*, also *A. artipes* which is in the same group. He puts *A. artemisiarum* (*Beckwithii*) here, which is also of the *Preussi*. *A. Bodini* (*debilis*) he places here, but it belongs with the *Inflati*, the same is true of *A. cerussatus* (*triflorus*), *Cusickii*, *debilis*, *humillimus*, *jejunus*, *leptaleus*, *ineptus* (*lentiginosus*), *microcystis* (*miser*), *sabulonum*, *serpens*, *subcinereus*, *Wetherilli*. He also puts *A. Preussii* here but it belongs in the *Preussii*. He puts *A. Reverchoni* (*lotiflorus*) here but it belongs in the *Lotiflori*. He puts *A. sesquiflorus* here but it belongs in the *humistratus* branch of the *Homalobi*.

He creates the genus *Phacopsis* to include *A. Pattersoni* and *praelongus* (*Pattersoni* var.) and adds *A. scaphoides* (*arrectus* var.) which belongs in the *Reventi-arrecti*. The first two species belong in the *Preussii*.

He takes up *Tium* Medic and makes another general mixup. *A. alpinus* (*andinus*) belongs in the *Alpini*. *A. arrectus*, *atropubescens* (*arrectus*), *eremiticus* (*arrectus* var.) belong in the *Reventi-arrecti*.

A. desperatus belongs in the *Argophylli*. *A. Drummondii*, *racemosus* and *scopulorum* belong in the *Galegiformes*. *A. obcordatus* and *variegatus* (*sparsiflorus*) belong in the *Sparsiflori*. *A. humistratus* belongs in the *Homalobi*. *A. distortus* belongs in the *Hamosi* probably.

He creates *Xylophacos* to include Gray's *Argophylli*.

PRESENT REVISION.

The writer began his work on the revision of the genus in 1895, a year after the appearance of Sheldon's abortive "Preliminary List," in the belief that no closet botanist could ever revise the genus properly, and with the intention to work out the genetic relationship of all the North American species in the field. I had already spent sixteen years in the field on the genus along with other flowering plants, but with no intention to revise it.

My first work was an examination of all the types in this country and photographing them, which was the first work of that kind in this country. Then some years were spent in a fruitless attempt to follow Gray and Watson. When I had the genus about half done the scheme utterly collapsed. The mass of genetic and ecological information accumulated in the field and the great amount of material seen which embraced all to be found in all the leading herbaria in the country, and the study of nearly every species in the field compelled me to attempt a new classification. For a time the arching of the ventral suture offered much encouragement, but this also broke down with a very few species. I then took up the genus from an ecological and genetic view-point, making much of geographical proximity, and this led me out where I believe the genetic relationship of all the species is no longer guess-work but an established fact. These studies showed that the intrusion of the sutures though valuable on the whole must not be relied on, nor the thickness of the walls of the pods, nor the inflation. The differentiation of the genus has gone along on other lines.

The genus originated in the Temperate life zone in its colder regions as is shown by the most primitive species the *Homalobi*, of which very few are found in hot regions and all are perennials.

I have tried to retain the old sectional names wherever this does not cause confusion. The new sectional names are taken from the leading species in the group. In subdivisions of sections, wherever groups are well defined I have named them in the same way.

That *Astragalus* is closest related to *Oxytropis*, *Crotalaria* and *Colutea* is evident, but the *Homalobi* remind one much of *Hosackia* and *Lathyrus*, the pods splitting and curling in the same way in several species.

I take the *Homalobi* to represent the lowest forms and *A. campestris* the lowest species. From this an early offshoot is the *Triphylli* presaged by the caespitose species *A. simplicifolius* and carried much farther in *A. montanus*. These are Plains adaptations. The *Lotiflori* represents another digression toward the inflated forms represented in the lowest group the *Debiles* also an earlier offshoot of the *Homalobi* and which reached considerable alteration in the *Inflati* of the arid and variably alkaline and hot deserts, and in the *Sparsiflori* of the more moist and sweet-soiled mountains which group also passes into the *Alpini* of the high and Arctic regions. It should be noticed that regions with deep snow produce thin-walled pods. Regions with little or no snow and with a tendency to alkali and a warm climate favor differentiation into thin-walled and inflated pods in offshoots of the *Debiles*.

The *Homalobi* again branch into the *Collini* which represents one of the two great lines of differentiation. The *Collini* branch into the *Podo-sclerocarpi* of the Columbia Basin and northern Great Basin

regions, in rather alkaline deserts and the **Reventi-arrecti** which have considerable differentiation in the same regions but spread to the north farther east. This last group amplifies into the **Uliginosi** a cosmopolitan group of plains, prairies and open woods in temperate regions. This division on growing in cold meadows and dry valleys passes into the **Hypoglottides**, and this again divides into the **Chaetodontes** under the altered climatic conditions of the Columbia drainage. But it should be noted that, all three groups grow in the same region in the west, but each under its own peculiar ecological conditions. Another offshoot of the **Homalobi**, close to the **Flexuosi** is the **Atrati** of the interior juniper mesas, which branches into the **Strigulosi** which belong mostly to the cool meadows and mesas and pine forests of Mexico.

The second main branch of the **Homalobi** is the **Flexuosi** which, in the colder regions of the north in sweet soil branches into the **Argophylli**, a group growing on dry benches and plains where there is some winter snow. It shows some differentiation into the **Malaci** which also are replaced by **Sarcocarpi** of cold plains, and the **Mollissimi** which extend beyond the limits of snow on plains to central Mexico, but in relatively cool regions. The **Argophylli** have some species that have secured some alkali tolerance, such as the species of the Navajo Basin. In the alkaline deserts and in clayey regions where the soil is very poor the **Flexuosi** pass gradually into forms with conspicuously inflated pods with rather thick walls, and the **Ocreati** and **Bisulcati** without inflation but with much alteration of walls by corrugations and sulcation at sutures and intrusion of the dorsal suture. The **Bisulcati** branch into the **Galegiformes**, and these again early give off the **Lonchocarpi**. The **Flexuosi** pass into the **Hamosi** which branch into the **Leptocarpi**, and these into the **Micranthi**, and the latter pass into the **Didymocarpi** the highest developed species. This whole line of the **Flexuosi** is for the most part a line of warm and variably desert regions. A very few species grow in moderately cool regions such as **bisulcatus**, **Drummondii**, and some **Hamosi**, but they are for the most part the result of long inhabitation of hot regions of the south and subject to the greatest influence of diverse ecological conditions.

In the system which I have used it has been my object to get related species together as far as a linear arrangement could do it, and I have therefore inverted the order of relationship in parts of groups to bring this about.

In order to facilitate understanding the genetic relationship I have appended a diagram of my view of the relationship of the groups.

My diagram of and arrangement of species is based wholly on relationship as indicated by the species of today. Whether this is the actual line of descent is a different matter for no one knows whether there has been retrogradation nor how much. A study of the Asiatic species might throw some light on this matter but the geological history is so localized that little benefit is liable to accrue from this source. The differentiation of the genus except in rare cases has manifestly been due to glacial and post-glacial agencies and these factors are well worked out.

GROUP DETAILS.

1. **Homalobi**. It is a debatable matter as to which species is the most primitive, but from its resemblance to *Hosackia* and *Lathyrus* I have assumed *A. campestris* to be the most primitive. But for systematic reasons I have placed first those species with the ventral suture the more arched and which belong in more humid regions and mostly at the north.

A. Wingatensis and *tenellus* fall together, with short or no stipe and small flowers. It is here that the **Debiles** branch off. The sti-

pitate species with larger flowers come next. *A. Coltoni* with purple flowers belongs to the Navajo Basin slopes. *A. stenophyllus* and *Antiselli* with white flowers come next, belonging to the mountain slopes of the northern Great Basin, the Columbia Basin, and the southern California plains in warmer regions, and almost connecting with the *Inflati* through *A. oxyphysus*. Another offshoot of the northern Sierras is in *A. Californicus* and *inversus*.

The second branch of the *Homalobi* has the ventral suture less arched than the dorsal for the most part, and as a whole belongs in warmer regions or at the south. *A. campestris* with pods wider above is cosmopolitan in the mountains, even reaching alpine places. *A. Pasqualensis* is placed here for lack of a better place, but its position is not determined. It is from the far south in Mexico. The species with pods not wider above are *A. junceus* and *Episcopus*. Species much as in *A. campestris* but with acerose leaflets are *A. simplicifolius* and *detritalis*. A marked differentiation of the group now comes in the species *A. montanus* which connects *campestris* with the *humistratus* group, and represents the alteration of *campestris* to thrive on the dry plains and stony forests of Wyoming to Arizona. *A. humistratus* and *sesquiflorus* represent a modification of *montanus* for the forests of Arizona and New Mexico to Mexico. Other modifications are *A. sericoleucus* for the Plains of Wyoming and Colorado, *A. Gilensis* for those of the Gila, *A. tegetarioides* for those of Oregon. *A. quinqueflorus* and *Pueblae* are Mexican outliers.

2. *Triphylli*. This group of two species represents a special adaptation to the wind-swept Plains.

3. *Debiles*. This offshoot of the *Homalobi* starts off near *A. tenellus* and its lowest species doubtless is *A. debilis* connecting the group with *A. tenellus* of the *Homalobi*, and also not greatly removed from *A. pauciflorus* of the *Inflati*. Then comes *A. Yukonensis*, and *leptaleus*, with *A. polaris* last. This little known species is very likely to belong with *A. alpinus*. The *Debiles* all belong in the north in cold regions in moist places with sweet or acid soil.

4. *Sparsiflori*. This group connects almost direct with the *Debiles* by *A. leptaleus* through *A. sparsiflorus*, with *A. obcordatus* next and *A. villosus* last, and belongs on the plains and prairies from Colorado southeastward.

5. *Alpini*. This group is perhaps as well placed as an offshoot of the *Sparsiflori* and closely related to the *Inflati*, though it is related to the *Atrati* and *Strigulosi* which represent it in the south. Its lowest species is doubtless *A. elegans* though the little known *A. Cermani* may be first, then comes the large stipuled forms *A. alpinus* and *Americanus*, and the small-stipuled forms *aboriginum* and *Coltoni*, all with a slightly produced dorsal suture, then we come to the sulcate and variably 2-celled forms *A. Labradoricus* and *andinus*. All this group belong in the high region or the far north, mostly in cold meadows and copses.

6. *Inflati*. This is an early offshoot of the *Debiles* or coordinate with it as an offshoot of the *Homalobi*, for *A. pauciflorus* is certainly closely related to *A. tenellus*. This is a group of the hot and variably alkaline deserts for the most part. Its two primitive species *A. pauciflorus* and *miser* belonging in sweet soil in the pine forests of the north. Among its single-celled small podded forms *A. Pulsiferae* and *diurnus* belong in the sagebrush benches of the southern Columbia Basin drainage and vicinity, *A. pubentissimus* in the Navajo Basin deserts in sandy places. *A. sabulonum* in similar places along the Colorado in Utah and Nevada, *A. aridus* in the hot deserts of the Death Valley-Mojave region, *A. Geyeri* on the sandy deserts of the Great Basin, *A. Julianus*, *proriferus* and *metanus* in the deserts of Lower California, *A. Vaseyi*, *Thurberi* and *Palmeri* in the deserts of

western Arizona and near California, *A. insularis* on desert islands of Lower California and *A. triflorus* in the sandy places from Colorado to central Mexico where there is little alkali. *A. pchnostachyus* in the salt marshes of the California bays, *A. Hornii* on the salt flats of the San Joaquin and southward, and *A. scalaris* an aberrant thing from the barrancas of Chihuahua. Among the single celled and large podded forms *A. subcinereus* and *pictus* grow with running roots in sandy sagebrush regions of Colorado to Utah and Arizona. *A. Wardi*, *serpens* and *nutans* grow from stout roots in sagebrush regions of southern Utah to adjacent Nevada. A peculiar group of seacoast species inhabits the California-Mexican region such as *A. vestitus*, *Pomonensis*. *Crotalariae*, *Miguelensis* and *Magdalenae*. Another more inland group but near the other is *A. macrodon* and *Douglasii*. Large podded forms of the Grand Canon region are *A. allochrous* and *Wetherilli*. All these are, except the last, plants with sessile pods. Balloon-shaped and variably stipitate plants are the diminutive *A. jejunos* of the Uintas, *A. Cusickii* of the lower Snake river drainage, and *A. Hookerianus* of the Sierras which comes close to *A. Cottoni*. Another quite distinct group and connected with the *Collini* is *A. oxyphysus*, *trichopodus* and *capillipes* which belong in the southern California region and are related to the balloon-shaped section. Plants with large and stipitate but not balloon-shaped pods are *A. leucophyllus*, *curtipes*, *leucopsis*, and belong in the coast region of California. These all have no joint to the stipe. Plants with jointed stipe and large pods are *A. lutosus* of the dry ledges of western Colorado, *A. megacarpus* of the desert clay bad lands of Wyoming and Utah. *A. oophorus* and *Bechwithii* of the sagebrush plains and hills of Utah to Idaho and Nevada. Plants with variously 2-celled pods are *A. triquetrus* and *Craigi* of the Sagebrush plains of Nevada and adjacent Oregon, and the cosmopolitan *A. lentiginosus*, at least as far as the western plateau region goes, not extending much into Mexico.

7. **Lotiflori.** This group would naturally be placed as a branch of the *Debiles* next the *Sparsiflori*, and may possibly belong there. But I prefer to place it as an offshoot of the *Homalobi* verging toward the *Argophylli* and near to the *Atrati* with which it seems related. The rather fleshy pods variously 2-celled would place it here *A. Mohavensis* belongs in the rocky gulches of the Death Valley region, and *A. circumdatus* in the Lower California region, *accumbens* (*procumbens*) on the mesas of northern New Mexico, and *A. lotiflorus* on the Plains from Wyoming to Texas.

8. The least modified group of the *Homalobi* in its beginning is the *Collini*, the pods being *Homalobous* but the flowers decidedly modified in the first three species *A. Tweedyi*, *collinus* and *porrectus*. Then the pods themselves become fleshy and inclined to corrugated and falcate in *Gibbsii*, which tendency is still more accentuated in *speriocarpus* and *Alvordensis*. All belong in the Columbia Basin drainage and vicinity, in soil not very alkaline.

9. **Podo-sclerocarpi.** This branch of the *Collini* shows a lengthening of the flowers, and expansion and lengthening of floral rachis a reduction of the leaves toward phyllodia and thickening of tissue to suit the alkaline conditions in which it grows. The pods become more fleshy and rapidly differentiate. It is almost exclusively a Great Basin group of the alkaline plains. *A. Toanus* of the border land of Utah and Nevada is the lowest. *A. pectinatus* and *Grayi* form a close group, the one on the Plains from Assiniboia southward, the other in the Green River Wyoming drainage. All these have short fleshy, sessile and little differentiated pods, but modified leaves Here branch off the *Preussii*. Then comes *A. Casei*, *pterocarpus*, and *tetrapterus* with doubly falcate and elongated pods inclined to stipitate and much modified. These all belong to the Great Basin and *A. tetrapterus* extends beyond to the drainage of the Virgin river and the Colorado near and in Utah. *A. Casei* keeps close to the

Sierras, and *A. pterocarpus* along the head of the Humboldt. Then come the stipitate *A. sclerocarpus* of the Columbia Basin sand dunes, *A. bicristatus* of the canyons of the Mojave, *A. Serenoi* and *canonis* of the alkaline seeps of the east base of the Sierras, and *A. pachypus* of the similar seeps at the head of the San Joaquin.

10. **Preussii.** This group is one with pods more inflated and mostly less fleshy, with leaves not modified and growing in hotter and less alkaline places and belonging mostly along the Colorado drainage, it seems to branch off early from the *Podo-sclerocarpi*. The purple flowered forms *A. Preussii* and *ampullarius* with reduced number of leaflets and thin-walled and inflated pods normally stipitate, and *A. limatus* with ample leaflets and fleshy and less inflated pods. *A. Preussii* goes from the Sierras to Colorado, *ampullarius* is local near the Kaibab, and *limatus* belongs in the Death Valley-Mojave region. The white or cream colored flowers have the rather tall *A. oocarpus*, a near relative of *A. Preussii* from the San Diego region, the remarkable *A. asclepiadoides*, probably nearest to *A. ampullarius*, of the Navajo Basin and upper Sevier, with a single great leaflet, and the fleshy-walled *A. Pattersoni* and *sabulosus*, also of the Navajo Basin, *A. Pattersoni* also going over into the Great Basin and on the Rio Grande drainage.

11. The other branch of the *Collini* is the **Reventi-arrecti** where this line runs toward the production of the septum into 2-celled pods. *A. reventus* and *adanus* represent the fleshy-walled side and belong in the Columbia drainage. *A. arrectus* in its many modifications to suit temperature conditions extends from the upper Columbia drainage to the Colorado. Here branch off the *Uliginosi*. *A. vallis* and *Bolanderi* represent an inflated and stipitate group reminding one of the sessile *A. lentiginosus* of the *Inflati*, the one species growing on the upper and eastern Columbia drainage, and the other in the northern Sierras. This group abounds in the sagebrush region where alkali is not excessive. Still another specialized member reminding one of the *Sarcocarpi* is *A. accidens* with plum-shaped and very fleshy stipitate pods inhabiting the pine forests of the Cascades, like its congener *A. Bolanderi* of the Sierras farther south.

12. **Uliginosi.** This early branch of the *Reventi-arrecti* is closely related to it through *A. terminalis* and *Oreganus*, species of the upper Columbia drainage and adjacent head of the Missouri, growing in sagebrush regions. *A. Canadensis* comes next with its stubby flowers and is cosmopolitan, from the Atlantic to the Pacific, growing in copses and prairies. *A. neglectus* an inflated modification reminding one much of the *Preussii* belongs in the Minnesota region in open woods.

13. **Hypoglottides.** this appears to be an offshoot of the *Uliginosi* as shown by the flowers, habitat, and pubescence of *A. nitidus*. The first species *A. nitidus* belongs on the Plains and extends westward to Washington. *A. agrestis* belongs in the sweet and cold meadows of alpine and subalpine regions for the most part, though it goes down into Middle Temperate in specially favorable places. Both species endure small amounts of alkali. This group is Asiatic and European and reaches a much better development there.

14. **Chaetodontes.** This group seems a natural modification of the *Hypoglottides*. *A. Austinae* is a caespitose modification of rocky ridges in the Sierras. *A. Spaldingii* and *Lyallii* are plants of the sagebrush plains and sandy slopes of the upper southern Columbia Basin. *A. Brauntoni* is a remarkable modification of the plains of the region west of Riverside California. This makes the end of the *Collini* branch of the *Homalobi*.

15. The **Lotiflori** is a group that is hard to place but seems better located as an independent branch of the *Homalobi* near the *Atrati* or of the *Atrati* itself. On the other hand it has some characters of the *Argophylli*, as though a branch of the *Flexuosi*.

16. **Atrati.** This group also branches off from the *Homalobi*

and near *A. junceus* and verges toward the Alpini and represents it in the south and warmer and drier regions. It has a tendency to fleshy or coriaceous pods, and with ventral suture the more arched. *A. Salmonis* is a fleshy and caespitose plant of cold ridges in the Blue Mountains Oregon, *A. obscurus* has much narrower and less fleshy pods and frequents the sagebrush benches of northern Nevada. *A. atratus* has about straight pods and is very variable. It belongs in the sagebrush-juniper regions. In the Boise region its pods are papery and its filiform stems straggle for several feet over the ground, in central Nevada its stems are spreading and short and pods chartaceous to almost coriaceous, in the Death Valley region its pods are almost fleshy and rather cartilaginous. *A. Ibapensis* is like the central Nevada *atratus* but with different leaves and grows in the Deep Creek mountains on sagebrush slopes. *A. Panamintensis* has quite fleshy pods, but they on drying are only chartaceous. It grows in the rocky canons of the Panamints of California.

17. **Strigulosi.** This group seems to be an early branch of the Atrati and like it has the ventral suture the more arched, and the pods are almost always stipitate and papery and inclined to inflated, and reflexed. *A. recurvus* and *straturensis* are in close relation with their narrow and linear, not inflated pods and acuminate base, and papery partial partition. They frequent the Grand Canon region, among the pines and brush. The rest of the group has oblong to globose pods either inflated or appearing so. *A. strigulosus* has pods acuminate at base and often at tip and with loose pubescence, and in its various forms extends from the Grand Canon to southern Mexico. *A. Brandegei*, *platytropis* and *Cobrensis* are peculiar species the first and last seemingly inflated but little if at all so, and little if at all stipitate; the first reminds one of *atratus*, of the Atrati and may belong there near the Idaho form of *atratus*, and it grows from Canon City Colorado through the Navajo basin in the Lower Temperate life zone. *A. Cobrensis* is more coriaceous and frequents the mountains of New Mexico and Arizona in the same zone. *A. platytropis* a very aberrant species of the dry mountains of eastern Nevada, Montana and the Sierras doubtless closest related to *A. Brandegei*. This rarely gets as low as the Lower Temperate life zone, and has globose and greatly inflated pods. Plants with prostrate stems or nearly so and elongated, and with stipitate pods, and plants almost wholly smooth grow in the meadows much as the Alpini but in central and southern Mexico. These are *A. Guatamensis*, *Painteri*, *Tolucanus* and *Rosei*. A similar species but creeping and rooting at the nodes is *A. reptans*.

18. **Flexuosi.** This goes off earlier than the Collini from the Homalobi in the tendency of the pods to be coriaceous and round in cross section, and in the small flowers of the parent group. The parent species is *A. flexuosus* of the northern Plains. *A. parviflorus* is a depauperate modification of the Plains, from which branch off the Ocreati. Then the species become inflated and the flowers larger and we have a natural series to the end, as the species extend southward. *A. gracilentus* connects this series with the parent and belongs in the dry pinon forests of Colorado and New Mexico. *A. Sileranus* is a straggling offshoot of the Kaibab region. *A. coriaceous* and *Antoninus* belong in the hotter regions of Mexico, and *A. pinonis* in the Sevier Basin Utah.

19. **Argophylli.** This is a natural offshoot of the Flexuosi in the line of pod thickening. *A. desperatus* of the hot ledges of the Navajo Basin is a near relative. *A. cibarius* of the sagebrush plains from Montana to southern Utah and westward is next, then come *A. iodanthus* and *Webberi* of the Sierra region. These are forms with little pubescence except in *A. desperatus*. Forms with mostly large pods quite fleshy and not inflated noticeably and with silvery pubescence not woolly are *A. argophyllus* of the Montana to Arizona slopes and plains. *Shortianus* of the Colorado and New Mexican plains and foot-

hills, *A. Zionis* and *remulus* of the Grand Canon region, and the small *A. tephrodes* of central New Mexico plains, and slopes. All these are either of the Lower Temperate life zone or reach a little up into the Middle. We now have a peculiar group of the Navajo Basin with cellular pods, *A. pygmaeus* and *Musiniensis*, in the Lower Temperate life zone. Then we have a group with pick-shaped hairs. *A. cymboides* and *Missouriensis* have rather small pods, the one belongs in the clay lands of the Navajo Basin, the other on the Plains from Montana to New Mexico. *A. amphioxys* is the third member of this group and has variously elongated and arched pods and belongs on the Colorado drainage and adjacent parts of the Rio Grande. The Group with woolly pubescence shows a tendency to inflation of pod but never very great. Of this *A. Newberryi* and *Eurekaensis* have hairy pods and belong in the Great Basin region though the first extends to the Mogollons and both in the Lower Temperate. Forms with woolly leaves and pods are *A. coccineus* and *funiformis* of the Death Valley region, *A. Utahensis* of the Great Basin in general and *A. inflexus* of the Columbia Basin. A species with very sparsely woolly pods and hairy leaves is *A. Purshii* of both Basins.

20. **Succumbentes.** This group with so many characters of the *Hamosi* as to the pods still is related to the *Malaci* on the one hand and the *Galegiformes* on the other. The flowers are those of the latter and the leaves and habit and even the pods more like the *Malaci*. But at best the relationship is remote, even to any known species. For the present I merge this in the *Malaci*.

21. **Malaci.** This group separates from the *Argophylli* early at *A. cibarius*. *A. Parryi* and *Feensis* with capitate flowers come first and belong to the Colorado foothills and New Mexical plains respectively. *A. ensiformis*, *malacus* and *Layneae* follow. The first species belongs on the high plateau south of St. George Utah; *A. malacus* along the eastern base of the Sierras and over to the Snake river on the Columbia drainage; *A. Layneae* from the southern Sierras to the Grand Canon. The whole group belongs in the Lower Temperate life zone, in and near the pinon and juniper mesas.

22. **Mollissimi.** This group, the highest differentiation of the *Argophylli* is compact and mostly Mexican. Species with smooth pods are *A. mollissimus* and *giganteus* of the Colorado and Texan to Arizona plains and mesas. Forms with stiff-hairy or shaggy pods are *A. Bigelovii* and *Phoenicis* of the New Mexican and Mogollon mesas, and a variety extending to central Utah. The form with felted pods is *A. Humboldtii* of the high valleys of Mexico. Forms with inflated pots are *A. Orizabae* of central Mexico, *A. orthanthus* of Coahuila, and *A. anisus* of Pueblo Colorado. Apparently all the species belong to the Lower Temperate life zone in well drained regions with little alkali.

23. **Sarcocarpi.** This branch of the *Malaci* starts off early also, apparently near *A. Parryi*, whose closest relatives are *A. Tennesseensis* and *Plattensis*; the one from the southern prairies from Iowa to Tennessee, the other from Indiana to Colorado and Texas on plains and prairies. The species with plum-shaped and very fleshy pods are *A. crassicarpus* and *Mexicanus* of the Plains and prairies from Montana eastward and southeastward to Texas.

24. The natural alteration of the *Flexuosi* is the *Ocreati* into which it passes at the start by the modification of the walls of the pods in grooves and ribs, but without intrusion of the suture noticeably. This group, like the *Bisulcati* has the flowers mostly with a strong and snake-like odor and inhabits the Navajo Basin region. The species with pick-shaped hairs are *A. sophoroides* and *confertiflorus*, the latter growing also in the Green River Basin of Wyoming. The species with normal hairs are *A. argillosus* of the Green River region in Utah, and *A. Moencoppensis* of the Little Colorado region, the former growing on the hot bare mesas, and the latter in the pine forests of the Mogollons.

25. **Bisulcati.** This group forms a slight modification of the *Ocreati* hardly worth separating from it. The species are tall, while the *Ocreati* are low, and the pods are bisulcate ventrally and pendent mostly, presaging the intrusion of the suture in the *Galegiformes*. *A. bisulcatus* abounds on the Plains and mountain valleys from the Saskatchewan to New Mexico. *A. Haydenianus* frequents the valleys of the Great Basin and Navajo Basin. *A. oocalycis* is an aberrant species with inflated calyx from Aztec New Mexico. All the group belong on plains and valleys with some alkali.

25. The *Galegiformes* in the first species show more differentiation in the mostly Y-shaped cross section without corrugations and sulcate dorsally, and broader white flowers and pods a little inflated, in *A. racemosus* of the Plains from Colorado to central Mexico, and *A. scopulorum* from the lower mountain gulches of Colorado to Utah. But *A. Drummondii* has a long and rugose pod with reniform cross-section, and not at all inflated. This frequents mountain valleys from Colorado to Utah and Montana. *A. Osterhouti* is an aberrant form harking back toward the *Homalobi*. It belongs on the Navajo Basin drainage.

27. **Lonchocarpi.** This group doubtless has a relationship, though a loose one with the *racemosus* part of the *Galegiformes*, being a little more aberrant than *A. Drummondii*. It is, like *A. racemosus*, a group of the alkaline plains. The pods though reminding one of the *junceus* part of the *Homalobi* are explanate along the dorsal suture, while *A. junceus* splits at both sutures and the valves curl and the leaflets are phyllodia-like as in that species. *A. Kaibensis* and *Duchesnensis* hark back toward *junceus* and inhabit the Navajo Basin, while *A. lonchocarpus* is local from western Utah to New Mexico and southern Nevada. The group might as well be placed as a branch of the *Homalobi* as here, but the tendency toward an impressed dorsal suture would place it here.

28. **Hamosi.** This group goes a step farther in the intrusion of the dorsal suture and the narrowing of the pods, and runs into all sorts of modifications according to the varying ecological conditions of the hot regions that it inhabits. It connects with the *Flexuosi* through *A. distortus glaber* and *Coahuilæ*. The first group of these three species is inclined to be a little fleshy-walled when fresh and with uneven sides, and imperfectly 2-celled. The first species belongs on the prairies of Oklahoma and Texas to Mississippi, the second in the barrens of the Florida region, and the third on the dry benches of Coahuila. The next group of species is inclined to be jointed to calyx but also not stipitate, is oxytropidoid and with pick-shaped hairs and 2-celled ascending pods. It belongs in the Juniper regions, *A. Arizonicus* on the swell south of the Colorado in Arizona, and *A. calycosus* from the Navajo Basin and Green River Basin of Wyoming to the Sierras and southward to the Mogollons. The rest of the *Hamosi* is without the pick-shaped hairs, and pods not coriaceous, with mostly Y-shaped cross-section, but 2-celled, mostly linear. *A. Bernardinus* and *Orcuttianus* with erect pods shortly stipitate belong in the eastern side of the southern Sierras in rather hot regions. The rest of the *Hamosi* have reflexed pods. *A. drepanolobus* is not stipitate and has shining pods and belongs in the southern Columbia Basin region. *A. Congdoni* and *Andersoni* are only minutely stipitate and softly silky all over and belong in the central Sierra region and with pods having a rather cordate cross section. *A. sylvaticus* is stipitate and with shining pods and whole plant about smooth, and abounds in the pine forests of the southern Cascades. *A. albens* has a peculiar depressed pod conspicuously stipitate and like all its predecessors but the first group jointed to calyx and has silvery pubescence closely appressed and belongs in the Death Valley region. The rest of the section

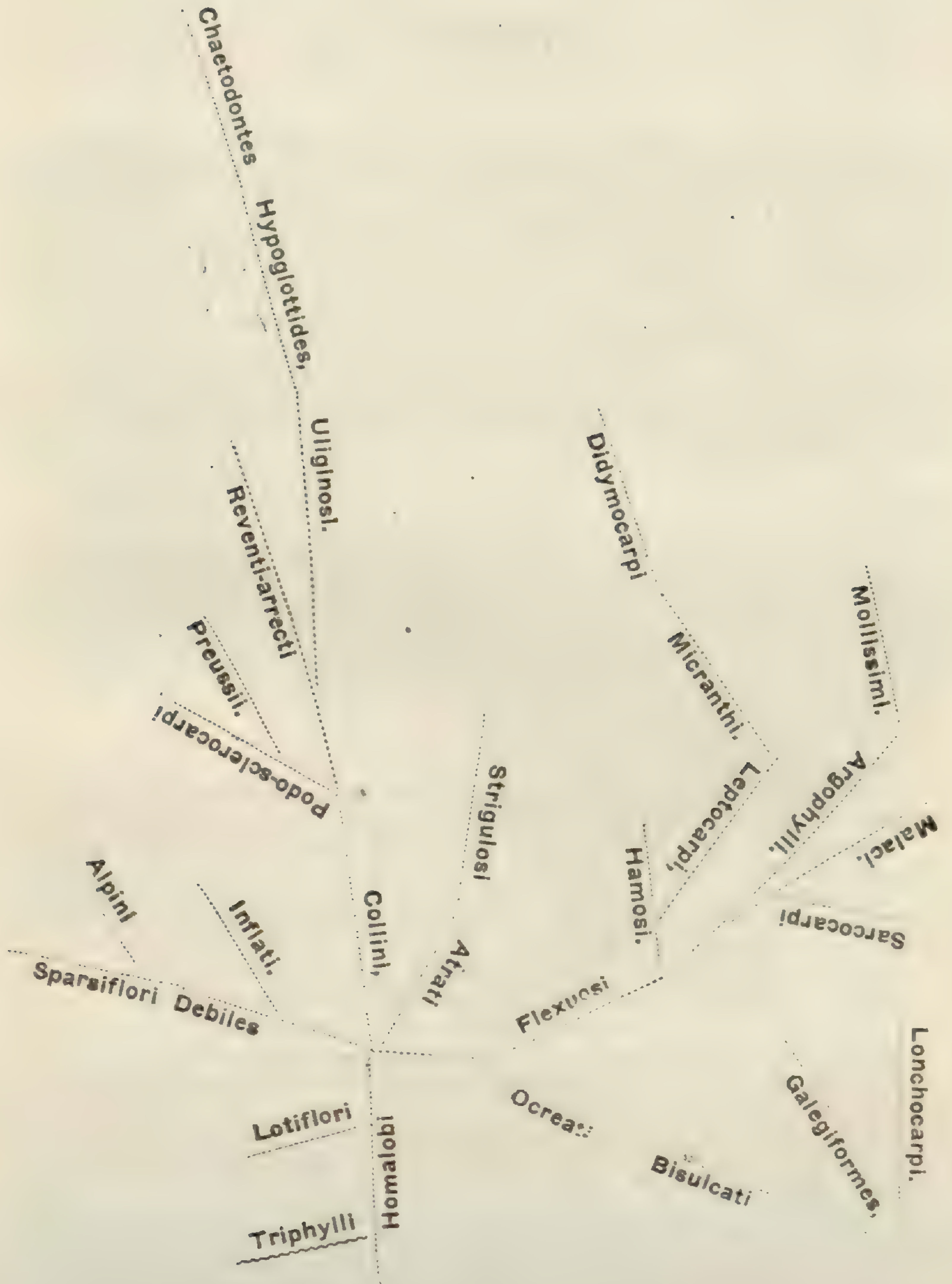
is without jointing of pod to calyx and with manifest stipe. The first group is herbaceous and with nearly prostrate and slender stems. *A. Howellii* has narrow pods, is inclined to be softly pubescent and with dirty-white flowers about 1 cm. long. It frequents the prairies of the lower Columbia Basin. *A. Mulfordæ* has the broad and a little inflated pods smooth, and has the small flowers of *A. campestris*, and belongs in the Upper Snake river region on sandy slopes. *A. Inyoensis* is the only annual with long and prostrate stems and brilliant purple flowers and broad and obcompressed pods as in *Mulfordæ* and belongs in the Death Valley region. The next group of the *Hamosi* is marked by the shrubby base, woolly pubescence and narrow pods. *A. Nevinii* has smooth pods and *A. Traskiæ* has woolly pods. Both belong on the islands of southern California. *A. Arthuri* is a remarkable plant with almost filiform and acuminate and elongated pods and the general habit of *A. Howellii* and belongs in the Lake Waha region of Idaho.

29. The *Leptocarpi* seem to branch off from the *Hamosi* early near the first group. The first division contains the species with blunt keel, and wings not lobed, and embraces two groups, the first containing *A. Francisquitensis*, *Lindheimeri* and *leptocarpus* with smooth pods and racemose. The first species belongs in the lower California region, and the other two on the Texan prairies, the latter species going to central Mexico. The second group has flowers in heads, and with two rather distinct segregations. *A. tener* and *Rattani* belong on the California plains and have pods never shaggy. *A. Wrightii* has shaggy pods and belongs on the Texan prairies. The second division of the *Leptocarpi* embraces the oxytropidoid forms with sharp or produced keel and a tendency to lobed wings, and wings wide above. *A. Nuttallianus* has pods arched most near the base and rarely inverted on a twisted pedicel, the keel variously sharp, and with obovate wings. This is almost everywhere in the Tropical life zone and covers most of the Lower Temperate throughout the Great Basin. *A. acutirostris* and *nothoxys* have acuminate keel and pods inverted on a twisted pedicel. The one belongs in the Mojave-Death Valley region, the other on the plains or low mountain slopes of southern Arizona, and extending into Mexico. The flowers of the *Leptocarpi* are seldom minute.

30. *Micranthi*. This is manifestly closely related to the *Leptocarpi* but with pods inclined to be obcompressed and rather sulcate at both sutures. *A. lentiformis* is peculiar in the much laterally flattened pod like *A. tegetarioides*, but it is manifestly an ally to *A. Lemmoni* of the same region namely the divide between the Great Basin and the Columbia drainage along the Sierras in the sagebrush. This group is almost wholly Mexican, with an outlier in Texas and three species reaching Arizona and California besides those mentioned. Plants with pediceled flowers in racemes are *A. Madrensis* of the pine forests of Chihuahua, the little known *A. ervoides* of Tepic, and *Luisianus* also of the forests of Oaxaca and Puebla. Plants with flowers in loose heads and rather few are the mostly woolly *A. Greggii* of Coahuila and southward. *A. Pringlei* of the Chihuahua plains, *A. parvus* of the regions of San Luis Potosi, and *A. Schaffneri* from the same region. Plants with flowers in dense heads and with axillary peduncles are those with narrow leaflets *A. Lemmoni*, from California, *Esperanzæ* from central Mexico, and *Chapalanus* from Jalisco. Plants with similar flowers but broad leaflets sessile in spikes and pods about sessile have two groups, with pods about linear which embrace *A. Hartwegi* from central Mexico, *A. militaris* from Chihuahua and adjacent Arizona, *A. Saltonis* from the State of Mexico, *A. vaccarum* from Arizona and Chihuahua and southward on dry hills, and the conspicuously con-

nate stipuled, and hoary *A. hypoleucus* with hairs fixed by the middle, from central Mexico. Forms with broad pods and flowers in spikes have two groups those with short spikes embracing *A. oxyrhynchus* and *Seatoni* from San Luis Potosi to Oaxaca. Plants with broad pods and long spikes are the the pubescent *A. Goldmani* from Chihuahua and *Clevelandi* from western California. Plants with stipitate pods in dense heads are *A. Purpusi*.

31. **Didymocarpi.** This is the natural culmination of the *Micranthi*. The species are annuals unless *A. diphacus* and *Angelinus* are more enduring. The pods are for the most part very small and much altered. The annuals separate into those with pods sessile and those with stipitate pods. The first group contains those with closely reflexed pods in spikes and the species are two, *A. reflexus* of the Texan prairies, and *A. nigrescens* of the hot Californian plains. This group also contains with erect pods, *A. Breweri* with a long beak and relatively large pods, and *didymocarpus* and *dispermus* with pods hardly longer than calyx and didymous and corrugated. These belong to the Californian plains and run over into the border of Arizona and Nevada. The species with stipitate and reflexed pods is *A. Brazoensis* of the Texan plains and prairies. The apparently perennial species are both Mexican, *A. diphacus* from Zacatecas, and *A. Angelinus* from the Valley of Mexico..



Genetic Relationship.

ECOLOGY.

To give the ecology of *Astragalus* would require the ecology of the Great Plateau, altogether too great a subject for this monograph. In Contributions No. 13 I went into the subject of life zones pretty fully, giving the main features and the basis on which they rest, and also went into the subject of barriers in their effect on the distribution of species in the west. These subjects will be treated briefly here.

Astragali have to contend with all the ecological factors that apply to herbaceous plants.

No species of *Astragalus* have become saprophytes, epiphytes, or parasites.

A. reptans is the only species that creeps and roots. None are truly stoloniferous.

Only about half a dozen species are woody and then only below such as some *Inflat* *A. leucophyllus* and the like, *A. Traskiæ* belongs with the *Hamosi*, none are true shrubs.

Nearly all species are tufted from vertical tap roots; none have tuberous roots though some have fleshy roots, particularly those growing in clay soil where it is almost impossible for annuals to grow, such as the Navajo Basin. *A. Musniensis* and *cymboides* have fleshy roots, the former 3-4 feet long, the same is true of *A. asclepiadoides*, *Pattersoni*, *sabulosus*, but the latter are fleshy more because of the alkaline soil.

125 species have woody roots. 11 species are biennial; 41 species are annual.

108 species have slender stems; 131 have delicate stems; 52 species have coarse and stout stems.

150 species have small leaves; 115 species have thick leaves; and 76 species have delicate leaves.

32 species grow in meadows; 61 in forests; and 112 in shade of brush or other plants; 120 are low plants; 38 species grow in sweet soil; 59 in alkaline soil strongly impregnated.

205 species have bladdery pods; 114 fleshy pods; and 144 have colored or blotched pods; none of the pods are truly edible.

128 species have small flowers; 133 large flowers; 7 coarse flowers; 24 delicate ones; 104 inconspicuous ones; 173 bloom in spring; 99 mature in two months, the rest in 2-3 months; 210 have white or cream-colored flowers.

Most of the alpine species have slender underground stems or branching root crowns or interlacing roots forming loose patches of plants, particularly the *Alpini*.

A. pictus and *subcinereus* have filiform and branching roots and long underground stems. *A. junceus* and *Duchesnensis* are much the same but less branched. Most of the *Homalobi* have prostrate and much altered. The annuals separate into those with pods sessile the same but stems coarser and woody. Many of the Great Basin species have stems with bark performing the duties of leaves, and leaflets reduced to phyllodia or very narrow. The annual species

with few exceptions are delicate and short-lived with delicate stems, small flowers and pods, and quick maturing, produced by the peculiar climate of the Tropical plains of the Arizona-California region and extending into the Lower Temperate life zone, such as *A. Nuttallianus*, *leptocarpus*, *Didymocarpi*, etc. Several of these annuals in the Mexican region start in the meager moisture of the spring and make a growth sufficient to mature pods and then rest in the dry season without dying out and in the fall rains grow vigorously and bloom again more copiously, even having a woody old stem which makes them seem like biennials or perennials, and for this reason we do not know yet what are truly annuals, among the higher groups. *A. Nuttallianus* is known to start in the fall and bloom as a winter annual. It is possible that this is true of *A. hypoleucus*. *A. amphioxys* blooms as a winter annual but is a perennial, though short-lived.

Most species have peduncles as long or longer than the leaves and in the upper axils. Very few have short peduncles with flowers nearly sessile in the axils, and concealed pods. Very few have the internodes longer than the leaves. Very few leaves persist in winter and those which do are woolly or hairy and act as a protection to the roots, such as *A. Utahensis*, *coccineus* and *lanereus* which protect them from the summer heat; *A. simplicifolius*, *sericoleneus*, *triphyllus*, *montanus*, *humillimus*, *Gilensis*, and *campestris* which along with very condensed stems and large stipules protect them from changes in temperature in winter and spring. Only those alpine plants are thus protected which grow on gravelly or rocky places where winter's snow is liable to be blown off.

As a rule there is no crowding with other plants, and species of *Astragalus* do not grow together. Exceptions to this are *A. Nuttallianus* which frequently grows among dense patches of other annuals, *A. didymocarpus*, *tener*, *leptocarpus*, *algrescens*, *Rattani* and *Lindheimeri* have the same and then become erect, though all naturally are depressed to prostrate.

The struggle for existence is purely one against climate and soil.

There is no evidence that any *Astragali* grow only on a lime soil, or an iron soil or any other particular kind of soil chemically speaking except those with active alkalies and acid. The plants of acid soils are the *Alpini* and the like, growing in decomposed vegetable humus. The plants growing only in actively alkaline soils (this is soils with 1 per cent or more soluble alkalies containing some carbonate of sodium) necessarily grow in clay soil in the bottoms of alkaline valleys. Such plants are *A. pectinatus*, *Grayi*, *Toanus*, and nearly all of the *Podo-scleroscarpi*, and some of the *Preussii* such as *asclepiadoides*, *Pattersoni*, *salulosus*, *ampullarius*, *megacarpus*.

Very seldom do we see any species of *Astragalus* growing in large patches, an exception to this is *A. andinus*, *agrestis*, *bisulcatus*, *Canadensis*.

Practically the only perennial species that come into competition with other species by crowding are the *Alpini*, *Debiles*, *Hypoglottides*, and in these groups there is no evidence of any differentiation due to crowding. The annual species when growing densely with other plants have more slender stems, smaller leaves and larger flowers and pods.

It is a common thing for the flowers of *Astragali* to vary greatly in size according to the humidity. Where the season is particularly dry the flowers are often almost rudimentary, where specially moist

they are large and long. This is particularly the case in the *Didymocarpi* and *Leptocarpi* and has led to the founding of spurious species on this character.

No fossil species of *Astragalus* have been certainly reported, while the geographical distribution points clearly to the Glacial period as the beginning of the primitive species.

Doubtless there will always be discussion as to the indigenous or foreign origin of some species but generally speaking there is no reason to seek a foreign origin for any not known to be continental. Those species which are now contiguous in the Arctic, the *Alpini*, are of European or Asiatic origin, as well as the *Hypoglottides*, and probably the *Uliginosi*. But the *Hamosi* of America though closely resembling those of Europe show no common origin with them but come down through the *Flexuosi*, or *A. nitidus*, and from the *Hamosi* come the rest, such as the *Leptocarpi*, *Micranthi* and *Didymocarpi*, though the latter may have come from the *Hypoglottides*. If the line of descent were not clear then we might be justified in seeking a foreign origin, but though there are abnormalities and gaps yet as a whole the line of descent of all the species is well marked. While to connect our anomalies with species of remote regions in Europe or Asia would require far more unscientific guessing and stretching of ecological laws than the facts warrant. For example *A. succumbens* has no near relative and yet its relation to the *Hamosi* is evident as well as with the *Galegiformes*. The *Uliginosi* are evidently of common origin with *A. nitidus* and presage the *Preussii*. The higher groups the *Leptocarpi*, *Micranthi* and *Didymocarpi* are the most differentiated and both ecologically and geologically have been subjected to the most changes of climate and the greatest migration, as shown by their present distribution and annual habit. We have hardly a suspicion of the spinose *Astragali* of Asia. *A. jejunus* and *humillimus* have rigid petioles as well as *A. sesquiflorus*, but never spinose. The adaptation of the species to climatic conditions is perfect as is that to soil whether the soil contains 1 per cent of soluble alkalies, or is acid as in the alpine meadows, or is barren clay as in the Navajo Basin, or the gravelly plains of Colorado and Montana, or the cooking-hot deserts of Arizona and Mexico. There is no evidence of present progressive differentiation, not even in such a cosmopolitan and variable species as *A. lentiginosus*. There is little hybridization and little evidence of fertility of hybrids. The species are easily definable though some are variable. The limits of a few species are uncertain, particularly Mexican, from lack of information. In fact many of the newer Mexican species are merely tentative, for there are at least a score still to be discovered which are liable to alter our conception of the limitations of the *Strigulosi* and *Micranthi*.

LIFE ZONES.

The prime factors in determining life zones are humidity (which includes that of the air and soil), temperature, soil, and light. Since the light is a matter of exposure, it varies locally, the same is true of the soil. Humidity is at the basis of all plant growth and should form the basis of all classification but unfortunately it varies with altitude, exposure, drainage and many other things and so Temperature is alone left to govern our plant zones. This varies with altitude and latitude. We first find what are the actual plant zones

by observation of all the species of a region, and then tie these limits as far as possible to known temperature curves. No two species of plants are equally sensitive to temperature and humidity, and so they will not be bound by the same limitations. For example the aspen is more sensitive to humidity than temperature and therefore will grow far down among the oaks under suitable humidity conditions, but where the humidity follows the temperature rather closely the aspen conforms to the usual life zone limits well, such as in the Great Basin and Colorado, New Mexico and Sierras, but in Montana and Idaho it grows out of its true life zone among the oaks, because of humid conditions. A species that stops short off at one life zone limit nearly always feathers out on the other. So the real life zone limits have to be determined by careful observation of all the species growing in it. In this search for zonal limits there are usually some species that conform pretty closely to them and they become very valuable in directing attention as we approach the edges of the zones.

The alpine regions are naturally limited by the upper edge of trees, and should as well include the meadows that lie between the tongues of trees commonly called subalpine meadows. The great forested region of the west is naturally limited by the spruce, the alpine fir and for the most part the aspen, and best of all the upper limit of the sagebrush and the deciduous oak. The forested region is the **Upper Temperate life zone** of which the Alpine and Arctic form only a subdivision. The great forested region of deciduous trees does not belong to the Upper Temperate life zone, but is mostly of the Middle Temperate. The Spruce zone is for the most part a region of evergreen, coniferous forests, though the western yellow pine, *Pinus ponderosa*, belongs in the Middle Temperate.

The **Middle Temperate life zone** is well defined by the distribution of the deciduous oak, the upper limit of the sagebrush and the lower limit of the aspen in the southern regions.

The **Lower Temperate life zone** is well defined by the distribution of the white cedar or juniper, *Juniperus Utahensis*, the pinon, *Pinus monophylla* and *edulis* and the Mexican pinons, and also by the lower limit of the deciduous oaks, the upper limits of the live oaks, and the creosote (*Larrea*) and mesquit (*Prosopis*) bushes, as well as the lower limits of the sagebrush.

The **Tropical life zone** is well defined by the distribution of the Creosote bush, mesquit, acacias, *Parkinsonias*, and barrel cactuses, (*Echinocactus*) and most of the live oaks. An exhaustive examination of the flora (see Cont. 13) shows that the Tropical life zone extends farther north than is commonly supposed.

A high humidity tends to throw the lower limits of the life zones below normal, particularly along streams, even so far as to go completely through the adjoining zone where you have species of the two zones almost side by side in canons, the upper zone plants along the bottom and the lower zone plants along the sides. A low humidity tends to throw the upper limits of a zone higher than normal as is shown along the exposed and dry slopes of mountains, where tongues of the lower zones run far up into the upper zone. These considerations have to be noted in placing species in their proper life zone. The accompanying map shows the life zones as actually worked out in the Great Plateau.

Life zones were first clearly marked out by Humboldt and his names should stand.

The upper limit of the Tropical life zone is about 60 degrees an-

naul temperature, that of the Lower Temperate about 49 degrees, but these will vary with the humidity. The limits given are for the arid west.

The two grand divisions of climate are **Tropical** and **Temperate**, the latter being divided into Lower, Middle and Upper. The Tropical is also divisible into Arid and Humid, but the arid is the only climate in our region, as affecting Astragali.

As to climatic distribution of Astragalus 97 species are Tropical, and of these 75 grow exclusively in this zone, 12 only extending into the Lower Temperate, and these mostly annuals. In the Lower Temperate are 122 species of which 61 are exclusive. In the Middle Temperate there are 125 species, of which 43 are exclusive. The Upper Temperate has 22 species, of which 5 only are exclusive.

UPPER TEMPERATE LIFE ZONE.

In Contributions to Western Botany No. 13, page 46ff. I discussed the distribution of Great Plateau species of plants in Glacial times. Briefly stated, the vegetation in the Glacial period was forced far south by the advance of the ice sheet. (The Glacial Period was preceded by a Tertiary tropical climate). There is little likelihood that any part of the United States had a climate warmer than the Middle Temperate of today, and then only along the tip of Florida, while most of the flora was Arctic, with a narrow strip of Middle Temperate flora in southern Arizona and which reached great proportions in Mexico, and another along the California coast. It was a period of high humidity and low temperate, which is hostile to specific differentiation necessarily so from the vast ice sheet of the Rocky Mountains to the Atlantic, and from the great lake of the Columbia Basin (See Contributions No. 14), and Lakes Lahontan of Nevada and Bonneville of Utah. The whole Columbia Basin was then a sheet of water, and there were about 18,000 square miles of water in Utah, and nearly as much in Nevada, while the mountains were almost wholly covered by a sheet of perpetual snow and ice. It can be readily seen that very few species of our present day Astragali could have existed outside of limited areas in central Mexico, if such areas existed at all which is very doubtful. For such a profound humidity throughout the United States must have transformed the entire arid region of Mexico into fertile prairies or forests, which would have precluded the existence of 90 per cent of the species of Astragalus. Had the genus any considerable development at that time, particularly in the line of arid plants, Mexico would now show the greatest number of species and the most differentiation, while in fact its species are relatively few and confined mostly to the Micranthi and allied groups though its diversity of climates, humidity and soil condition is greater than in the United States. This would indicate a differentiation after the close of the Glacial period and not before. Whether these early Astragali passed the generic limits into *Colutea* and *Crotalaria* etc. is not capable of proof, but is unlikely, since the gap is too great.

Following the uniform rule the Arctic meadows that laid next the ice sheet and extended from Ocean to Ocean must have formed a broad area through the southern States of Missouri and Texas and over the low Plains of Arizona, New Mexico and southern Nevada and around the Sierras into the two big valleys of western California, and into the Columbia Basin around Lake Columbia which then filled most of the Basin. This was an ideal climate for the

Alpini and the cold region Homalobi. The Homalobi must have been represented by *A. campestris* and *montanus*, (both of which are alpine still in some forms), throughout as is shown by their stranded occurrence now in isolated places from the mountains of New Mexico and the Mogollons of Arizona to the Sierras. *A. tenellus* followed a little later along the forest area. The Alpini surely were there in *A. andinus*, *Labradoricus* and *elegans* which are similarly but not so widely distributed. *A. aboriginum* followed a little later along the forests, the present alpine forms seem to be derivatives from the lower altitude forms, though the type form belongs to the tundra region of the far north and is confined to it. This species had a wide distribution as is shown by its occurrence on isolated peaks from Colorado to the Sierras, but if it ever reached far south it must now be represented by the Strigulosi in that region and which are natural derivatives from this group or the true Alpini, as is the group Atrati, of the central plateau region.

The Hypoglottides group was represented by *A. agrestis*, a modification of *A. Hypoglottis* of Europe, of Arctic and subalpine meadows as is shown by distribution similar to that of the Alpini. This species has secured a tolerance enabling it to thrive even as low as the upper limit of the Lower Temperate life zone in cold meadows throughout the Great Plateau almost to Mexico. *A. nitidus* seems to be a later offshoot of the dry Plains of the north in Montana and eastward, and *A. Austinæ* and the *Chætodontes* occupy similar regions in the Columbia Basin and the Sierras, and *A. Yukonensis* in the far north.

The Debiles group seems to have been there in *A. Bourgovii* and *polaris* but the only derivatives now left at the south are *A. debilis* and *leptaleus* which have a wide distribution but are local or rare in wet meadows and descending into the Middle Temperate life zone from central Colorado to central Utah and northwestward to the Columbia Basin.

The presence of Arctic species in such widely separated regions as the alpine peaks of mountains from Arizona northward, separated by arid areas, and so remote from the present Arctic was fully explained by the pamphlet of Gray and Hooker on their transcontinental trip in the later seventies, also by me in 1883 in the "Origin of the Flora of the Great Basin," and in Contributions No. 13, and by others later. The only rational explanation is the one there given that of migration following the close of the Ice age, and is demonstrated by geological history beyond the possibility of dispute. The present isolation is simply the invasion of a hotter climate due to geological or astronomical changes which kill the native vegetation and drive its progeny farther up the mountains along with the climate to which it is adapted till either the vegetation is all killed by the peaks not being high enough to support a suitable climate or the Arctic growth is confined to narrow limits near and at the tops. To attempt to account for these islands of Arctic vegetation on the high peaks by bird and other animal distribution and wind action is not tenable. The various modifications of the high peak climates caused by surrounding aridity below is shown by such species as *A. Austinæ* and the *Chætodontes* from *A. agrestis*, and from *A. Bourgovii*, etc.

The Inflatii seem to have been offshoots of the Debiles during the forest period of the floor of the Great Basin, and were represented by *A. pauciflorus* and *miser*. The great characteristic of this group is its rapid differentiation as the climate grew warmer, and its almost total lack of differentiation in the forest areas of the north.

A. Hookerianus and *Cottoni* being almost the only species of cold climates (*A. Cusickii* and *jejunus* are hot climate modifications of the *Hookerianus* branch). *A. platytropis* is of doubtful origin, probably an invasion from warmer regions.

The present distribution of the *Mollissimi* would indicate their general distribution in Glacial time on the plains of Mexico and this would account for the differentiation of the group since then by isolation in the mountains, being forced up from the Lower Temperate life zone then prevalent on the plains to the same zone now prevailing in the mountains. *A. Bigelovii* and *mollissimus* are the only species still prevailing on the plains.

The occurrence of *A. nitidus* would indicate its presence then on far southern plains in the Middle Temperate life zone and its differentiation into the *Uliginosi* at a very early time. The fact that it does not exist out of the sodded region seems to indicate a lack of access, barriers, in that region, (the Great Basin and Columbia region) but no such barriers exist, though its congener *A. agrestis* is freely distributed there. The explanation is found in the narrow soil adaptability of the species, it will grow in moist meadows, or anywhere but in the peculiar free drainage and small rainfall of the plains, which conditions are not found in the Great Basin. This is shown again by the great dissimilarity in the species of the same zone under apparently similar conditions, and in the absence of many such species in the Sierras, which indicates a much greater climatic diversity than appears on a casual inspection. This is easily understood on inspection of the rainfall curve which shows a great lack in summer rainfall in the region west of the sodded area where though the annual amount is the same, the bulk falls in the summer in the sodded area and in the winter (out of the growing season) in the Pacific drainage.

The total Arctic and alpine species are eight. The meager number of species in all genera and their close relation to those of the forest area do not permit the separation of this treeless region from the other, except as a subdivision of the Upper Temperate life zone as a whole.

The Upper Temperate life zone, also called the spruce zone which extends from the treeless regions at the north to the deciduous oaks and the upper limit of the sagebrush, and (in Colorado and the Great Basin) the lower limit of the aspen, must have disappeared from the plains of Arizona and northern Mexico giving way to prairies, and fringed the Mogollon slopes and the lower Sierra foot and higher plains as the Arctic flora climbed the mountains on the gradual recession of the Ice Age. The forest flora covered the plains region from Kansas eastward. The wet meadows and similar open spaces and the rocky regions were the only places where *Astragali* could thrive. The modified forms of *A. campestris* and *montanus* evidently grew on the rocks. The new form coming in and adapted to the forests *A. tenellus* is cosmopolitan and must have come in at this time as shown by its present distribution. It was a marked deviation from the *campestris* type though not a great one and presages the *Inflati* in *A. pauciflorus* which dries black in the same way and is not far removed from it genetically.

At this time the *Alpini* show differentiation in *A. elegans*, *aboriginum* and *Americanus*, forms adapted to the forest areas.

MIDDLE TEMPERATE LIFE ZONE

With the advent of the Middle Temperate climate from the south climbing over the southern slopes of the Great Basin and replacing the dense forests with oaks and open parks and prairies and supplemented by the mountain barriers and hot lower regions as barriers there arose many isolated areas with peculiar climates suitable for plant differentiation. The regions of Arizona, southern Nevada and

California replaced the oaks with junipers, pinons, and sagebrush. What was the Middle Temperate flora of the Arizona and Mexican plains while the Spruce flora filled the Great Basin region never will be known, but this much we know, there was little plant differentiation. *A. argophyllus* seems to have branched off the *Flexuosi*. *A. mollissinus* and *Humboldtii* represented the *Mollissimi*; *A. nitidus* the *Hypoglottides*; *A. Canadensis* the *Uliginosi*, but none of these seem to have differentiated farther, since all the changes seem to have come later when this flora had ascended the mountains of Mexico and the Great Basin. Probably the *Alpini* were replaced by the *Strigulosi*, for the *Strigulosi* do not occur northward. It is probable that the *Debiles* branched from the *Homalobi* at this time, for these plants belong rather to the wet meadows of the Middle Temperate than higher. At the same time the Plains region seems to have seen the origin of the *Flexuosi* and the first of the *Hamosi* and *Micranthi*. There is good evidence that the *Homalobi* expanded at this time in the *junceus* group, but the great change in the group did not occur till the Middle Temperate flora occupied the Great Basin and the flanks of the Mogollons and Sierras as is shown by present distribution. The great fresh water lakes of the Great Basin and Columbia region began to dry up at this time, and the oncoming alkalinity put an end to the acid soils of the forests and of the forests themselves and all that flora. The spruce area now was confined to the lower mountain slopes and higher valleys of the Great Basin and to the Idaho region and the middle slopes of Colorado. The drying up of the great lakes put an end to the water distribution from the Wasatch to the Sierras and from Western Montana to the Cascades, a feature so characteristic of the water period, and for the first time the element of barriers began to be felt in east and west distribution, and became more prominent as the aridity progressed. That the Middle Temperate flora was differentiated somewhat since the Lower Temperate has crowded it off the floor of the Great Basin and up the adjacent mountains is evident, but there is little evidence of any change at the north. *A. campestris* has given way to *simplicifolius*, *sericoleucus*, *triphyllus* and forms of *montanus* on the Plains, and in the Mogollon region to *A. humillimus* and *humistratus* and the latter species has even invaded the southern flanks of the Great Basin. *A. simplicifolius* has spread through western Wyoming to the edge of the Great Basin and covered the lower flanks of the Uintas on both slopes, on the south slope a new form appears in *A. detritalis*. *A. montanus* has become adapted to almost every form of climate prevailing in the Great Basin in its various varieties, growing even in the edge of the Tropical. *A. junceus* has split up in the Sierras into *Californicus* and *inversus*; and in the Navajo Basin into *Duchesnensis* and *Coltoni* and which also run down into the Lower Temperate with other derivatives such as *Episcopus* and *Woodruffi*. A new form *A. stenophyllus* presaging the *Collini* has come in on the northwest of the Great Basin and throughout the Columbia region. *A. montanus* seems to have had another offshoot in the Columbia region in *A. tegetarioides*. The long continued isolation due to barriers, the climatic changes, sparseness of vegetation and absence of crowding, and struggle to harmonize with increasing alkalinity and temperature has produced many new forms. The Navajo Basin the newest geologically had its floor covered by this flora, but it has been replaced today by the Lower Temperate, and the Middle Temperate flora fills a narrow strip around the rim. The same is true of the floor of the Great Basin as a whole except at the extreme north. The localization of the Middle Temperate flora indicates that most of the species originated since the present period of aridity came on, it is therefore not possible to sep-

relate the former flora of the floor of the two basins from the present except by the present isolation of species. The distribution of *A. ciliaris* and *Shortianus* would indicate an early origin. The wide and almost cosmopolitan distribution of *A. lentiginosus* would point to a very early origin but this is only apparent as the nature of the pods is such that wind transportation is sufficient to account for it, while all its affinities and its development would indicate an origin much later in the Lower Temperate from which it has spread to the Middle Temperate. There are many instances of similar invasions by other species. *A. Hookerianus* now grows freely in the Middle Temperate life zone though its home was in the spruce zone. The same is true of *A. aboriginum*, a plant now normally of the Middle Temperate which came from the spruce zone. The Astragaline flora of the great Plains region to the Atlantic is of little interest, the climate being that of latitude only, presenting none of the divisions so marked in the Great Plateau due to barriers of mountains and arid plains and great differences in humidity, as well as soil conditions. There is nothing in the flora to indicate ancient origin of the few new forms. *A. neglectus* may have been an offshoot of *Canadensis*, early or late. *A. Plattensis* and *Tennesseensis* are manifestly late modifications of the *Sarcocarpi*. *A. distortus* and *glaber* are evidently products of a hotter climate than the Middle Temperate and probably are related to the *Hamosi*. This region alone furnishes abundant evidences that the so much vaunted struggle for existence by crowding is a myth. *Astragalus* is a genus of sunlight and open air, a genus of hills and exposed rocks, meadows, prairies, plains and drifting sands. Crowding alters its habits but not its species. It is a genus essentially of the sodless regions of the west.

The disappearance of the continental ice sheet was clearly caused by elevation of the Arctic lands shutting off the water at the north and by a change in the Ocean currents of the Pacific. This at the same time shut off the moisture from the Great Basin and the Columbia region, but the latter lake was drained by erosion as well, following the close of the Ice age, the Great Basin was not, but was a clear case of advancing aridity. The disappearance of such vast bodies of water as that of the Columbia Lake and the two great lakes Lahontan and Bonneville, each about 18,000 sq. miles would have a profound effect on the climate, and at last ceased to have an appreciable effect in increasing the natural humidity of the region. This necessitated the extinction of the Middle Temperate flora from the floor of the Great Basin and the invasion from the south of the Lower Temperate. This resulted in the replacement of the spruce flora of all the region north of Utah by the Middle Temperate nearly as far as the Canadian line, and the extinction of the Middle Temperate flora throughout the Great Basin, some of the Columbia Basin, and the Navajo Basin as to the floor of those basins. This formed many isolated regions in the mountains of the Great Basin, and caused the flora to disappear on all the lower mountain ranges in the Basin at the south and in New Mexico, Arizona, Mexico and California. Our knowledge of the floral migrations of Mexico is meager, but we know that the Middle Temperate flora has entirely disappeared except in isolated places in the Sierra Madre plateau, and on the volcanoes of central Mexico and southward at high elevations. The true Upper Temperate flora never seems to have existed in Mexico at all since what there is is clearly a modification of the Middle Temperate. Now in Mexico not only the Middle Temperate has been replaced by the Lower Temperate but even this has for the most part given way to the arid Tropical except on higher ranges and peaks. Geological evidence is clear that this period of aridity has been at least 10,000 years old since the erosion of the old Bonneville beaches would in-

dicates at least that long a time since the period began.

The almost universal distribution of Middle Temperate species as a whole could be largely accounted for by bird migration and wind distribution because almost every mountain range has a larger or smaller area of this flora along its flanks and the ranges are for the most part west of the Wasatch about twenty miles apart, and for the most part parallel north and south, while the great Uintah range ends on to the Wasatch like the shank of the letter "T." But when we come to study the species by groups we find they clearly show origin by differentiation of primary forms. The present distribution is also a matter of water transportation by means of the great lakes Lahontan, Bonneville, and Columbia. The similarity of forms of the Wasatch to those of the east base of the Sierras on the old shore lines is noticeable, as is that of the Bitterroot and Flathead region of western Montana to the east base of the Cascades. *A. Utahensis* occurs along the old shore lines in the Sierras and Wasatch, and *A. Gibbsii* and *collinus* have similar distribution in the Flathead-Cascade regions. This similarity is still more noticeable in other genera such as *Allium* and *Lupinus*.

From geological evidence we know that the Middle Temperate climate persisted a long time in the West, and was displaced only by the drying up of the lakes. Then it migrated a little farther north after abandoning the floor of the basins and invading parts of Wyoming, Idaho and Montana, and extended to the Saskatchewan on the Plains. For the same reason it ascended toward the tops of the higher ranges of Arizona and Mexican regions. It still persisted in the Sandias, Mogollons, Catalinas, Santa Ritas and Huachucas, and even covered the tops of the Sierra Madres of Chihuahua and formed broad belts on the Volcanoes of central Mexico.

In the eastern and Atlantic regions the only representatives of the Middle Temperate are the Uliginosi and a very few Argophylli and Sarcocarpi. The Plains region has *A. montanus*, *triphyllus*, *lotiflorus*, *crassicarpus*, *Missouriensis*, *Plattensis* and *mollissimus*. The Colorado-New Mexican region in the mountains has of the Homalobi such species as *campestris*, *junceus*, *montanus*, *tenellus*, *simplicifolius* in the north and *humistratus* and *humillimus* at the south. Of the Debiles *A. leptaleus* and *debilis* are in the mountain meadows and extending over to the west, and *sparsiflorus* in the Colorado region. Of other groups *A. aboriginum* and *andinus* are in the mountains *lotiflorus* and *pectinatus* on the Plains, *megacarpus* in the western mountains, *nitidus* on the Plains, *agrestis* in cold meadows, *parviflorus* on the plains, Flexuosi there also and in the foothills with *gracilentus* at the south, *Missouriensis* and *Plattensis* are on the Plains, and *Parryanus* and *Shortianus* in the foothills with *Feensis* at the south. The Uliginosi are cosmopolitan.

The Montana-Idaho-Wyoming-British American region has a good assortment of Homalobi as was to be expected. those already named including *A. sericoleucus*: It also has the Triphylli and Debiles: the Inflatii have *pauciflorus* and *miser*; the Alpini, *A. aboriginum* and *andinus*. *A. lotiflorus* is on the Plains. *A. pectinatus* and *Grayi* represent the Podo-sclerocarpi. The Uliginosi have *A. Canadensis*, *terminalis* and *Oreganus*. The Hypolottides are there. *A. flexuosus* is there. The Argophylli have *cibarius*, *inflexus*, *Missouriensis* and *argophyllus*. *A. crassicarpus* represents the Crassicarpi. There is *A. bisulcatus*. The Galegiformes have *Drummondii* and *racemosus*.

The Columbia Basin region has the usual Homalobi and steno-phyllus: the Debiles have *Bourgovii*, *debilis* and *leptaleus*; the Inflatii have besides those named *A. Craigi*, *diurnus* and *lentiginosus*. There are the usual Alpini. There are the Collini. There is *A. Beckwithii*, *accidens* and *Alvordensis*. There are the Reventi-Arrecti| There

is *A. Canadensis*, *A. agrestis*. The *Chætodontes* are there except *Brauntoni*. The *Argophylli* have *argophyllus*, *cibarius*, *inflexus*, *Utahensis*, *Purshii*. There are *A. atratus* and *Salmonis*, *malacus bisulcatus*, *crassicarpus*. The *Hamosi* have *sylvaticus*, *Mulfordæ*, *Howelli*, *drejanolobus*, *Arthuri*.

The Eastern Great Basin region has the usual *Homalobi* and *humistratus*; also *A. debilis*, *jejunus*, *serpens*, *andinus*, *Canadensis*, *agrestis*, *megacarpus* and *Brandegei*. The *Argophylli* have *argophyllus*, *cibarius*, *Utahensis*, *Purshii*. The *Galegiformes* *Drummondii* and *scopulorum*, the latter a late immigrant. There is *A. calycosus*. The Western Great Basin has in addition to these given *A. platytropis*, *stenophyllus*, *tegetarioides*, *aboringum* and *obscurus*.

The Mogollon region has among the *Homalobi* *A. humillimus montanus* and *humistratus*; also *gracilentus*, *mollissimus*, *Feensis*, *Phoenicis*.

The Sierra region has among the *Homalobi* *Californicus*, *inversus* and *stenophyllus* and *campestris*. There are also *A. Hookerianus*, *Bolanderi*, *platytropis*, *obscurus*, *Canadensis* *agrestis*, *Austinae*. The *Argophylli* have *Webberi*, *iodanthus*, *Utahensis* and *Purshii*. The *Hamosi* have *Congdoni*, *Andersoni*, *sylvaticus*, *lentiformis* and *Lemmoni*.

The Mexican plateaus and Arizona region have on the peaks few species. There are *A. humistratus*, *Hartwegi*, *militaris* and *strigulosus* in the border, and farther south the *Strigulosi* and *Mollissimi* abound on the plateaus, and the *Flexuosi* are scarce.

The total Middle Temperate species are 121 or 28 per cent of the whole.

The lower Temperate climate which has prevailed throughout the floor of the Great plateau at the south except in the Arizona region since the drying up of the great lakes has isolated the Middle Temperate on the mountain slopes and exterminated it on all the lower ranges at the south, there being little left of this life zone south of the Mogollons. There is a little in lower California on the San Pedro Martir, and in the San Bernardino Mountains California, besides the large area in the Sierra Madres mentioned. The floor of the Great Plateau north and northwest from Cache valley Utah to the Blue mountains, and northeastward to the Saskatchewan is Middle Temperate, but the *Astragaline* flora is meager. This is another confirmation of the fact that a cool climate and moderate humidity are not conducive to species differentiation. Over half of the Middle Temperate species are the products of isolated areas at the south, while many species at the north are Spruce zone plants that have acquired a Middle Temperate tolerance, such as *A. agrestis*, *andinus*, *elegans*, *aborinum*, *montanus*, *tenellus*, *Hookerianus*, *Bourgovii*.

LOWER TEMPERATE LIFE ZONE.

The extinction of the Middle Temperate flora on the floor of the Great Plateau, as far south as the upper limits of Utah, by the lower Temperate has left a vast area with innumerable and isolated climatic regions differing greatly in humidity, soil and exposure, and admirably suited to varied plant forms and therefore the species of *Astragalus* are the most numerous of any life zone. In Glacial times if there was any such area at all it must have been far south in the Irapuato-Guadalajara region of central Mexico. That there could hardly have been such a region is forced upon us by the character of the species and their distribution. *A. Bigelovii*, *Humboldtii* and *mollissimus* of the *Mollissimi*; *A. racemosus*, *Hartwegi*, *Nuttallianus* and *triflorus* are the only species with anything like general distribution, while all but the last two are of Middle Temperate, and the last of Tropical origin. The great diversity of the species from Arizona northward

shows that they are manifestly variably localized forms of recent origin and with no Mexican connection. Take for example the species of the Navajo Basin. The exclusive species are *A. Coltoni* and its forms (though this occurs sporadically even as far as Pioche), *detritalis*, *Duchesnensis*, *Kaibensis*, *Episcopus*, forms of *junceus* and *montanus*, *sesquiflorus*, *Wingatensis*. The *Inflati* have *lutosus*, *pubentissimus*, *Wetherilli*, while *subcinereus*, *Wardi* and *megacarpus* are nearly local, and only *Geyeri*, *lentiginosus*, *pictus*, *oophorus* and *sabulonum* are at all widely distributed. Of the *Preussii* *ampullarius*, *asclepiadoides*, *Pattersoni* *sabulosus* and *Preussii* are most local and only *Pattersoni* passes its borders a little, and *Preussii* only has any considerable distribution in the the Great Basin. *A. Mortoni* is generally distributed, *A. Brandegei* and *straturensis* are local. These are not of the *Preussii*. Of the *Argophylli* *A. cymboides*, *desperatus* and *Musiniensis* are local, *pygmæus* nearly so extends to the Mogollons, while *Utahensis* and *Purshii* cover the region to the Sierras. Of the *Mollissimi* *A. Bigelovii* alone extends through to eastern Nevada and southward. Of the *Ocreati* every species is local except *confertiflorus* which runs up into the Green River Basin. Of the *Bisulcati* *A. Osterhouti* only is local, and *Haydenianus* extends only to central Nevada. Of the *Lonchocarpi* the single type species extends only to central Nevada. Of the *Hamosi* *A. calycosus* extends throughout the Great Plateau. Out of the forty seven species twenty six are local and half the rest are only slightly extra-limital, and only two or three go to the Arizona deserts.

Of the **Green River Basin** (to the north of the Uintas) there is one exclusive species *A. Grayi*.

The species of the **Great Basin** show similiar localization. Out of its thirty nine species and about twenty varieties *A. serpens* of the *Inflati* is local; of the *Podosclerocarpi* *Casei*, *pterocarpus*, *tetrapterus*, *Serenoi*, *Toanus* are local; of the *Inflati* *Beckwithii* is nearly local. Of other groups are forms of *arrectus* *atratus*, *pinonis*, *iodantus*, *malacus*, *Andersoni* are exclusive or nearly so, or about fifteen out of forty seven forms, while nearly a dozen more are only a little extra-limital.

In the **Columbia Basin** *A. speirocarpus*, *sclerocarpus*, *inflexus* and *succumbens* are local out of fourteen species.

In the **Rio Grande region** only *Feensis* and *oocalycis* are local. due to lack of barriers.

In the **Mogollon plateau region** the *Homalobi* have *A. Gilensis* as an exclusive; the *Inflati* have *nutans*, *allochrous*, *Palmeri*, *Thurberi*; the *Lotiflori* *A. accumbens*. Other groups have *Cobrensis*, *recurvus*, *remulcus*, *Phoenicis*, *funereus*, *coccineus*, *ensiformis*, *Arizonicus*.

The **Sierra Madre region** has *scalaris* and *Goldmani* as exclusives.

In the **Plains region** the only exclusives are *lotiflorus*, *anisus*, *pectinatus* and *parviflorus*.

The **eastren region** has *villosus*, *Tennesseeensis*, *distortus* and possibly *glaber* as exclusives.

The **Sierra region** has few exclusives such as *bicristatus*, *pachypus*, *Bernardinus*, with *Andersoni* and *Gibbsii* nearly so. The total species in this life zone are 152 or 35 per cent of the whole.

This life zone occupying the center of the Great Plateau has barely got a footing in the center of the Columbia Basin and extends but little north of Pueblo Colorado. At the south it has been exterminated at all elevations below 3,000 ft. in the Utah-Nevada region, and at all elevations below 4000 ft. in the Arizona region, the Tropical taking its place. This has resulted in broad fringes around nearly all the mountain ranges at the south and limited by live oaks.

TROPICAL LIFE ZONE.

The Tropical life zone has displaced the Lower Temperate throughout the floor of the Great Plateau from Albuquerque, New Mexico southward, from the head of the Colorado in a narrow strip to the south of the Grand canon, from Springdale, Utah, along the Rio Grande and westward through the low valleys of Nevada to the Sierras near Harwathorne, Nevada. It also occupies the floor of the two great valleys of California, and the Coast line from near Mendocino southward. It is clearly an immigrant from far southward as its localized flora shows. The Astragaline flora is practically all of the arid Tropical division. Its 120 species or 28 per cent of the whole would seem to indicate a period of great differentiation but when we consider that the break between the Tropical and Temperate floras is an enormous one, far greater than any other divisions, we see that *Astragalus* has not kept pace with other genera, but its differentiation is insignificant considering the opportunities for change. A hot climate and varying humidity are ideal for plant differentiation. Had *Astragalus* had any wide pre-glacial distribution at the south the Tropical life zone would have shown many times the species that the Temperate ones show. On the other hand everything shows that what Tropical species we have are derivatives from the cold climates, and their offshoots. The only cosmopolitan species are *A. lentiginosus* and *Nuttallianus* whose distribution is mostly affected by wind movement. The majority of the species are annuals and belong to the higher groups.

At the north most of the species are those that belong in the Lower Temperate life zone but extend down into the Tropical such as *A. Episcopus*, *sabulonum*, *triquetrus*, *Preussii*, *tephrodes*, *Zionis*, *amphioxys*, *Arizonicus*.

Along the central floor of the region we find *A. aridus*, *sabulonum*, various forms of *lentiginosus*, *Mohavensis*, *Preussii*, *Panamintensis*, *atratus* var., *coccineus*, *tephrodes*, *albens*, *acutirostris*, *dispermus* and *didymocarpus*.

The Mojave region adds *A. Vaseyi*, *limatus*.

The Texan region has *leptocarpus*, *giganteus*, *Wrightii*, *Brazoensis*, *Lindheimeri*.

The Californian valleys have a peculiar flora due to the proximity to the Ocean, mostly forms of the *Inflati*, though some isolated forms occur such as *A. tricarinatus* an inland form, *Antiseili*, *pychnostachyus* of the salt marshes and *Brauntoni* near by, with *A. Hornii*. The dry valleys have *capillipes*, *curvipes*, *Douglasii*, *leucophyllus*, *leucopsis*, *macrodon*, *Miguelensis*, *oxyphysus*, *Pomonensis*, *trichopodus*, *vestitus* of the *Inflati*. The *Preussii* have *oocarpus*. The *Hamosi* have *Traskiæ*, *Nevinii*, *didymocarpus*, *dispermus* and *nigrescens*.

The Mexican region has *Pasqualensis*, *Pueblæ*, *quinqueflorus*, *Douglasii*, *Julianus*, *leucopsis*, *Miguelensis*, *Magdalensæ*, *proriferus*, *vestitus*, *metanus*, *triflorus*, *circumdatas*, *reptans*, *Rosei*, *Guatamalensis*, *Anthonus*, *Orizabæ*, *orthanthus*, *Arizonicus*, *Coahuilæ*, *Orcuttianus*, *Francisquetensis*, *leptocarpus*, *Nuttallianus*, *nothoxys*, *Chapalanus*, *Esperanzæ*, *ervoides*, *Greggii*, *hypoleucus*, *hypoxylus*, *Luisianus*, *parvus*, *Pringlei*, *Purpusi*, *Schaffneri*, *Saltonis*, *didymocarpus*, *Angelinus* and *diphacus*. Th life zones of half these species are not clearly made out and may belong higher in the Lower Temperate or even some in the Middle Temperate. The forms which occur only on the Lower California coast are *Douglasii*, *Julianus*, *leucopsis*, *Magdalensæ*, *proriferus*, *vestitus*, *insularis*, *metanus*, *Hornii*, *cirmumdatas*, *Orcuttianus*, *Francisquetensis*.

BARRIERS.

It should be borne in mind that only the Wasatch, Uintas and Rocky Mountains and southern Arizona floor were above the Ocean at the north in pre-Tertiary times. Then the whole Plateau was elevated. The great Plains emerged. The Navajo Basin was drained. The lofty plateau of the Great Basin dropped many thousands of feet to its present elevation and all its valleys drained to the Colorado. The erosion of the Colorado tilted up the southern end of the Great Basin till the Colorado drainage ceased and the Basin filled up with two vast lakes, Lahontan on the west and Bonneville on the east. The Columbia region was filled by Lake Columbia.

These facts had an important bearing on the later distribution of the flora of the Great Plateau, from the Rockies to the Sierras.

Toward the close of the Ice age there was easy access of plants from the east and west as far south as central Utah along the Uintas, through lakes Bonneville and Lahontan to the Sierras, and from the Yellowstone region to the edge of the Columbia lake along the present Snake river valley which was an arm of that lake at that time, and from there to the Cascades by water transportation. The Rocky Mountains also at the south swung round by continuous flora from New Mexico by the Mogollons to the Kaibab and northward along the Wasatch Plateau to the Bonneville region. It was only at the close of the great lakes period that the element of barriers became at all effective in stoppage of plant migration.

LOCAL FLORAS.

Local floras, a comprehensive name for plant formations, often containing many minor plant formations, are caused by barriers which may be temperature, humidity, alkalinity, acidity, light or soil, or mountain chains, wind movements and the like.

In 1895 I published in my plant schedules a complete list of these local floral regions in all the life zones, of the Great Plateau.

As I have stated humidity is the greatest factor in determining plant formations and local floras.

The Great Plateau is readily divisible into four well marked groups. The Rocky Mountain region which extends from Santa Fe New Mexico along the Atlantic watershed to the far north; The Pacific slope region extending from Central Montana westward and southward to the Ocean and the Mogollons; the Pacific Coast region from San Francisco southward; The Albuquerque and the Arizona-Mexican plateau region from the lower Colorado to Texas and southward. The first is a region of spring and early summer rains, the sodded area, and extends to the Atlantic. The second is the region of winter rains and midsummer showers or none, the sodless region. The fourth is the region of fall and late summer rains. The third is the region of winter rains. All these general floras are remarkably distinct.

Each one of these grand divisions is readily separable into subdivisions according to conditions.

I will take up a few of the more important here.

The Navajo Basin is the most unique of all local floras. It was the floor of a very salt inland sea in the Jurassic which became less salt in the Cretaceous period. Upon it vast sandstones were laid down, and upon these vast clay beds. This Basin is formed by the watershed of the upper Colorado from the Grand Canon north. It really includes the Green River Basin of Wyoming which is cut off from it by the Uinta Mountains, but which I keep distinct for

climatological reasons.

The rapid erosion of the Colorado river and its two confluent the Grand and Green have left precipitous walls about 2000 feet high on the west and north and east, and on the south high dome like uplifts and great box canons. The floor of the basin is from 4000 to 5000 feet elevation, the western crest 8000 feet, the north 12000 feet, the east 10000 feet, while the south exclusive of the canons is 5000 to 6000 feet. The great barriers effectually cut off moisture from almost any region and the rainfall is little over 4 inches per annum, while the relative humidity is often 10 per cent. There are a few summer showers and there is some snow in the winter or an occasional shower. The annual temperature runs from about 49 degrees at the north to nearly 60 degrees at the south. There is rarely a foot of snow at any one time at the north and none at any time at the south. There are heavy spring frosts at the north, and no permanent winter snow cover. The soil from the center northward and westward is a loose and highly alkaline gray clay. South of the center it is all a light and deep red sand, carrying much alkali. The low rainfall and humidity makes it seem like an absolute desert. It is the nearest to it of any region in the west except the salt area forty miles wide west of Great Salt Lake. This region is traversed by the Grand, Green, Duchesne, Fremont, San Rafael, Dolores and San Juan rivers, all of which canon more or less below the floor. Wherever the waters can be taken out upon the land the soil becomes very fertile after about three years' leaching of the alkali. The floor of the region is covered by the Lower Temperate flora; the deep canons from the head of the Colorado down by the Tropical. The high walls have the Middle Temperate. The Astragaline flora is unique. On the clay plains and particularly along little draws *A. asclepiadoides* stands erect mostly singly or in twos from a deep tap root, with its large shiny leaves, and having almost exactly the habit of *Asclepias cryptoceras*, but more erect, which grows in the same region. *A. ampullarius* has much the same habit farther south. The coarse and tufted *A. Pattersoni* grows much the same but prefers bottoms. *A. sabulosus* a close relative of *Pattersoni* grows where alkali seeps out of stiff slopes. *A. Haydenianus* grows around irrigation ditches and along trails as if an immigrant but appears more at home on the edges of oak brush higher up. On gentle slopes and where there is a little sand mixed in *A. confertiflorus* grows in small tufts, and where there is more sand *A. argillosus* grows along with it with much the same habit. Along the ridges where there is more or less loose sandstone rock *A. Preussii* grows singly or nearly so. On the ridges themselves the variety *Eastwoodæ* grows with tufted habit and low. In the crevices of flat or gently sloping sandstones masses *A. desperatus* is at home. In the loose sand along the bottoms and in gulches *A. pubentissimus* grows singly and flat on the ground as a winter annual. In the canons in sand *A. Moencoppensis* is local and rare. On open sand stretches and in drifting sand *A. pictus* is scattered here and there. The densely tufted *A. Episcopus* prefers sand with rock close below, and *A. Woodruffi* prefers sand dunes, with its innumerable wiry stems and masses of purple bloom. *A. montanus* sometimes grows from crevices of hot rocks. *A. Coltoni* abounds on gravelly mesas among the pinons and sometimes on the rocks. *A. detritalis* grows in gravelly draws near Theodore. *A. lutosus* is found in tight crevices on bare rocks near Dragon. *A. junceus* grows on gravelly mesas as does *A. Wingatensis*. *A. sesquiflorus* grows in mats in the wide crevices of hot sandstones at Kanab. *Brandegei* and *straturensis* grow in

the shade of oak brush, the former also in abandoned fields. *A. simplicifolius* is rare on bare mesas at the north. *A. Geyeri* and *lentiginosus* are scattered over the sandy plains. *A. subcinerus* replaces *pictus* at the south. *A. megacarpus* is rare along the high draws and in the edge of the oak zone in very barren clay. *A. amphioxys* is frequent over the sandy plains, as is *A. pygmæus* at the north. *A. cymboides* and *Musiniensis* frequent the gravelly mesas. *A. Utahensis* and *Purshii* are rare higher up, in the gravel. *A. scopulorum* occurs in the oak brush. *A. debilis* grows in high meadows as does *A. argophyllus*. *A. lonchocarpus* grows on alkaline and sandy flats and slopes. The unusual spruce zone species occur on the high peaks but they are not distinctive. The effect of barriers is such that the whole flora is very peculiar. Very few species extend over to the Rio Grande drainage beyond the San Juan. *A. asclepiadoides*, *Coltoni*, *lonchocarpus*, *Megacarpus* and *Haydenianus* pass over the Wasatch Plateau into the edge of the Great Basin. Only *A. Geyeri* and *lentiginosus* are of general distribution, caused evidently by winds from up the Colorado. A few species come in from the north around the Uintas such as *confertiflorus*, *pygmæus* and *simplicifolius*, but only the latter is a real immigrant as the others have migrated out rather than in. *A. calycosus* has come in from the Great Basin. *A. tenellus* has come down from the high peaks. *A. Utahensis* and *Purshii* are evidently immigrants, as is *A. argophyllus*. It is interesting to note the effects of certain ecological factors on the development of certain species. *Astragalus desperatus* is normally a densely tufted plant from a woody crown and about six inches high, with long leaves and many leaflets and long peduncles having many densely racemose flowers about 1 cm. long. This is when it grows in wide crevices in the sandstone rocks. When it grows in loose sand areas on the rocks and near them it is much the same but mostly prostrate in mats. When growing in tight and narrow crevices which is the common state on bare rocky knolls or eroded and gently sloping rocks it is reduced to a rosette often only $\frac{3}{4}$ inch wide with short leaves and few leaflets and short peduncles with only a flower or two and a single mottled pod. The flowers are then hardly larger than *A. montanus* and broad, and the general appearance is that of the *tegetarius* variety, the whole closely resembling *A. humillimus* but with few stems and not densely matted in broad mats.

On the Tropical part of the Navajo Basin annual *Inflat* come in, on the sandy stretches.

This Basin belongs in the second grand division.

The Green River Basin of Wyoming is a little area with the same badland soil as the upper Navajo Basin, but is far colder. Its flora is peculiar, with several distinct forms, but in *Astragal* is not worth mentioning except one form, *A. Grayi*, a derivative from *A. pectinatus*. Its climate is a mixture of the Atlantic and Pacific humidity and rainfall.

The northern Plains region has a meager *Astragaline* flora, belongs to the first grand division and is caused chiefly by wind movement and the low rainfall and temperature of the trough along the east base of the Rockies.

The Columbia Basin is an interesting group of the Pacific grand division of floras. Its factors are mountain isolation, snow cover except in the center in winter, rather high spring humidity continuing more or less through the summer, and almost total absence of summer rains. This insures a copious spring flora, and a conspicuous grass cover but no sod. There is a limited alkaline area in narrow stretches where few peculiar *Podo-sclerocarpi* flourish. The grass region supports the *Collini* and *Reventi-Arrecti*, and some *Argo-*

phylli and Homalobi.

The Oregon-Washington coast region is a normally forested area with no distinctive flora and no Astragaline importance.

The Siskiyou region of southern Oregon is a very small and isolated area caused by barriers and rather low humidity but not worth any special treatment here.

The Great Basin region belongs with the Pacific group and is easily separated into the Bonneville and Lahontan, or the eastern and western part, embracing the area that does not drain to the Colorado or the Columbia. It is a high plateau region with parallel mountain ranges about a mile high every twenty miles and running north and south, bounded on the north by the low sagebrush and juniper hills of the Columbia drainage, on the east by the lofty Wasatch range and its Wasatch Plateau extension at the south, on the south by no barriers but the Tropical climate of the Colorado and on the west by the Sierras. The flora is quite different from other regions. There is much intergrading at the north, some at the east and west and little at the south.

The annual temperature ranges from 53 degrees to 50 degrees on the floor, the humidity from 25 per cent to 49 per cent, and rainfall from 6 to 12 inches on the floor. The soil is gravelly, with very little sand, and there are wide areas in the centers of the valleys with alkaline clays. There is no river system except the Humboldt on the west and the Jordan, Sevier, and the Bear on the east. It is a region of scattered springs and short sinking streams. The upper Snake river region has much in common with the Great Basin but really belongs in the Columbia drainage. Its flora has a few peculiarities.

The Bonneville section is characterized in its Astragaline flora by the great development of the Argophylli, to which its soil and elevation are peculiarly adapted. The alkaline areas have few species *A. Toanus* being about the only peculiar species, though *A. tetrapterus* grows where there is a little alkali. *A. Wardii* and *serpens* are other peculiar species of the Sevier region. The Lahontan section is characterized by an excessive development of the Podo-sclerocarpi in the alkaline part, such as *A. Serenoi*, *a. canonis*, *pterocarpus*, *Casei*; the Malaci occur on the gravelly mesas, also *Andersoni*, *Gibbsii*, etc.

The Mojave-Colorado river region from Springdale Utah to the Sierras and southward to Mexico contains a peculiar flora, with many local branches and yet all are connected in a general whole hard to separate. The region is one of great temperature and minimum humidity and almost no rainfall. Its flora appears only in the spring and often for years at a time does not develop at all worth mention. Each subdivision of the region has a few *prælongus*, forms of *lentiginosus* and *amphioxys*, *Layneæ*, *Zionis*, *remulus*. The Amargosa Desert-Death Valley region has *A. Mohavensis*, *albens*, *Panamintensis*, *triquetrus*, *acutirostris*. The Mojave-Salton Sink region has *A. limatus*, *Vaseyi*, *aridus*, *Thurberi*, *Palmeri*, etc. The soil of this region is almost wholly sand. There are many forms of *A. lentiginosus*, and other more widely distributed species.

The Arizona-New Mexican floor has a similar climate to the above but very different in the summer and fall rains which clothe the plains with verdure. Many species of *Astragalus* grow there, but few are local. We have *A. nothoxys*, *Arizonicus*, *tephrodes*, etc. The soil is mostly sand on the floor and gravel on the slopes. This belongs to the fourth grand division.

The Texan plains belong in the same division of fall rains and have a number of peculiar species, mostly annuals, such as *A. leptocarpus*, *Lindheimeri*, *Brazoensis*, *reflexus*, *giganteus*, *Wrightii*, etc.

The Mexican Plateau is also a division of fall rains and has in-

numerable subdivisions and many peculiar species. There are the Chihuahua plains, the Yaqui-Sonora region on the floor, and on the high plateaus are many valleys and mountain ranges with interesting floras. The most important are Sierra Madre plateau, the Coahuila ranges, the Mt. Colima region, the Valley of Mexico and similar valleys of central Mexico, Popocatepetl, the San Luis Potosi region, the Lake Chapala region, and others.

Passing from the floor of the Great Plateau we find far less species differentiation, but almost every range of mountains has a distinctive flora more or less separate from any other. The Colorado Rocky Mountains are interesting and include the Yellowstone on the north and New Mexican on the South to Santa Fe. There is the Glacier Park region of Montana, the Blue Mountains of Oregon, the Sawtooth and Bitterroots of Idaho and Montana, the Wasatch and Uintas of Utah, the Deep Creek in western Utah, the Schell Creeks and Clover mountains of eastern Nevada and the West Humboldts of western Nevada, and also the Malheur range, the Pioche region, the Charleston peaks, the Funeral and Panamint mountains, the Providence range, the White mountains of California, the Cascades, the Coast range, the Sierras, the San Bernardinos, the San Jacintos, San Pedro Martir, Mogollons, Sandias. Catalinas, Santa Ritas, Chiricahuas, Huachucas, Floritas, and several ranges in western Texas. It would be too tedious to go into the floras of each, and in addition they are only local and feather into the adjoining regions.

The distribution of *Astragalus* at the far north has nothing of importance. A few species range throughout the forest region to the tundras of the Arctic. There are no distinct floral regions worthy of note beyond the Saskatchewan, nor has the Atlantic region any significance beyond the usual life zone limits. The peaks of New England have a few alpine and high latitude species.

LIST OF SPECIES BY LIFE ZONES AND LOCAL FLORAS.

UPPER TEMPERATE LIFE ZONE.

ALPINE AND ARCTIC.

ARCTIC

Debiles.
 Polaris.
 Yukonensis.
 Inflatl.
 Gormanl.
 Alpini.
 andinus.
 Labradoricus.
 Americanus.
 Alpinus

ALPINE IN BRITISH AMERICA.

Homalobi.
 campestris
 Debiles.
 Bourgovii.
 Alpini.
 andinus.
 Labradoricus.
 aboriginum.

ALPINE ATLANTIC.

Alpini.
 Labradoricus.

COLORADO-YELLOWSTONE.

Homalobi.
 campestris.
 montanus.
 Alpini.
 andinus.
 Labradoricus.

UINTA.

Homalobi.
 campestris.
 montanus.
 Alpini.
 andinus.

WASATCH.

Homalobi.
 campestris.
 montanus.
 Alpini.
 andinus.
 Inflatl.
 serpens.

EAST HUMBOLDT.

Homalobi.
 montanus.
 Alpini.
 Labradoricus.
 aboriginum.

BLUE MOUNTAINS

Homalobi.
 campestris.
 montanus.

MOGOLLONS.

Homalobi.
 campestris.
 montanus.

SIERRAS.

Homalobi.
 campestris.
 montanus.
 Inflatl.
 Hookerianus.
 Alpini.
 andinus.

SPRUCE ZONE.

BRITISH AMERICAN.

Homalobi.
campestris.
tenellus.

Debiles.
Bourgovii.
debilis.

Inflati
pauciflorus.

Alpini.
andinus.
aboriginum.
elegans.
Americanus.

Hypoglottides.
agrestis.

COLORADO-YELLOWSTONE.

Homalobi.
campestris.
montanus.
tenellus.

Debiles.
debilis.
leptaleus.

Inflati.
pauciflorus.

Alpini.
andinus.
aboriginum.
elegans.
Americanus.

Hypoglottides.
agrestis.

Strigulosi.
platytropis.

UINTA.

Homalobi.
montanus.
campestris.
tenellus.

Alpini.
andinus.

Hypoglottides.
agrestis.

WASATCH.

Homalobi.
campestris.
montanus.
tenellus.

Alpini.
andinus.

Hypoglottides.
agrestis.

NEW ENGLAND.

Alpini.
andinus.
Labradoricus.

EAST HUMBOLDTS.

Homalobi.
campestris.
montanus.
tenellus.

Alpini.
andinus.
Labradoricus.
aboriginum.

Hypoglottides.
agrestis.

Strigulosi.
platytropis.

BLUE MOUNTAINS

Homalobi.
campestris.
montanus.
tenellus.

Debiles.
Bourgovii.
debilis.

Alpini.
andinus.
aboriginum.

Hypoglottides.
agrestis.

CASCADE-OLYMPICS.

Homalobi.
campestris.
tenellus.

Alpini.
andinus.

Inflati.
Cottoni.

Hypoglottides.
agrestis.

SIERRAS.

Homalobi.
campestris.
tenellus.

Inflati.
Hookerianus.
Reventi-Arrecti.

Bolanderi.
Hypoglottides
agrestis.

Chaetodontes.
Austinæ.

Strigulosi.
platytropis.

NEW MEXICAN

Homalobi.
campestris.
tenellus.

Alpini.
andinus.

Hypoglottides.
agrestis.

MOGOLLONS.

Homalobi.
tenellus.
Hypoglottides.
agrestis.

MIDDLE TEMPERATE LIFE ZONE.

ATLANTIC SLOPE DIVISION.

EASTERN STATES.

Uliginosi.
 Canadensis.
 neglectus.
 Argophylli.
 Missouriensis.
 Sarcocarpi.
 crassicarpus.
 Plattensis.

COLORADO-MONTANA PLAINS.

Homalobi.
 montanus.
 simplicifolius.
 sericoleucus.
 campestris.
 junceus.
 tenellus.

Triphylli.
 triphyllus.
 hyalinus.
 Debiles.
 Bourgovii.
 debilis.
 leptaleus.
 Inflati.
 pauciflorus.
 miser.

Alpini.
 aboriginum.
 Lotiflori.
 lotiflorus.
 Podo-Sclerocarpi.
 pectinatus.
 Uliginosi.
 Canadensis.
 Hypoglottides.
 agrestis.
 nitidus.

Flexuosi.
 flexuosus.
 parviflorus.
 Argophylli.
 cibarius.
 Missouriensis.
 Parryi.
 Shortianus.
 Sarcocarpi.
 crassicarpus.
 Strigulosi.
 platytropis.
 Bisulcati.
 bisulcatus.
 Galegiformes.
 Drummondii.
 racemosus.
 Sparsiflori.
 sparsiflorus.

Pacific Slope Division.

UINTA.

Homalobi.
 simplicifolius.
 sericoleucus.
 montanus.
 junceus.
 Debiles.
 debilis.
 Triphylli.
 triphyllus.
 Inflati.
 jejunus.
 megacarpus.
 Uliginosi.
 Canadensis.
 Hypoglottides.
 agrestis.
 Argophylli.
 argophyllus.
 Utahensis.
 Purshii.

Podo-Sclerocarpi.
 Galegiformes.
 Drummondii.
 scopulorum.

WASATCH.

Homalobi.
 Grayi.
 campestris.
 junceus.
 montanus.
 tenellus.
 humistratus.
 Debiles.
 debilis.
 Inflati.
 serpens.
 oocarpus.
 megacarpus.
 Uliginosi.
 Canadensis.

Argophylli.
 argophyllus.
 Utahensis.
 Purshii.
 cibarius.

Galegiformes.
 Drummondii.
 scopulorum.

EAST HUMBOLDTS.

Homalobi.
 junceus.
 tenellus.
 Uliginosi.
 Canadensis.
 Hypoglottides.
 agrestis.
 Argophylli.
 Utahensis.
 cibarius.
 Purshii.

MIDDLE TEMPERATE LIFE ZONE.

Pacific Slope Division.

EAST HUM-
BOLDTS.

Strigulosi.
platytropis.

Hamosi.
calycosus.

COLUMBIA
BASIN.

Homalobi.
campestris.
montanus.
stenophyllus.
tenellus.
tegetarioides.

Debiles.
debilis.
Bourgovii.

Inflati.
Craigi.
miser.
pauciflorus.
lentiginosus.
Cusickii.
diurnus.
Beckwithii.

Collini.
collinus.
Tweedyi.
Gibbsii.
speirocarpus.
Alvordensis.

Reventi-Arrecti.
arrectus.
adanus.
reventus.
vallaris.

Uliginosi.
Canadensis.
terminalis.
Oregonus.

Hypoglottides.
agrestis.
nitidus.

Chaetodontes.
Spaldingii.
Lyallii.

Argophylli.
argophyllus.
inflexus.
cibarius.
Utahensis.
Purshii.

Atrati.
atratus.
Salmonis.

Malaci.
malacus.

Hamosi.
Mulfordæ.
Arthuri.
Howellii.
drepanolobus.

Sarcocarpi.
crassicarpus.

Bisulcati.
bisulcatus.

SIERRAS.

Homalobi.
Californicus.
inversus.
stenophyllus.

Inflati.
Hookerianus.

Reventi-Arrecti.
Bolanderi.

Hypoglottides.
agrestis.

Chaetodontes.
Austinae.

Argophylli.
Webberi.
iodanthus.
Purshii.

Hamosi.
sylvaticus.
Congdoni.
Andersoni.

Inflati.
lentiginosus.

Strigulosi.
platytropis.

Uliginosi.
Canadensis.

Malaci.
malacus.
Micranthi.
Lemmoni.
lentiformis.

ARIZONA-MEXICAN DIVISION.

MOGOLLONS.

Homalobi.
humillimus.
humistratus.
montanus.

Flexuosi.
gracilentus.
Fendleri.
Sileranus.

Argophylli.
pephragmenus.
castanaeformis.

Mollissimi.
mollissimus.
Bigevoii.
Phoenicis.

CATALINAS.

Homalobi.
humistratus.

Micranthi.
Hartwegi.

MEXICAN PLAT-
EAU.

Strigulosi.
Guatamelensis.
Painteri.
Tolucanus.
strigulosus.

Hamosi.
Seatoni.

Micranthi.
Hartwegi.
militaris.
etc.

LOWER TEMPERATE LIFE ZONE.

ATLANTIC SLOPE DIVISION.

MISSISSIPPI
VALLEY.

Sarcocarpi.
Plattensis.
Mexicanus.
Tennesseeensis.
Sparsiflori.
villosus.
obcordatus.

Leptocarpi.
distortus.
glaber.

PLAINS.

Mollissimi.
anisus.
mollissimus.
Bigelovii.
Sarcocarpi.
Plattensis.

Argophylli.
Shortianus.
amphioxys.
Feensis.

Flexuosi.
flexuosus.
gracilentus.

Lotiflori.
lotiflorus.

Pacific Slope Division.

NAVAJO BASIN.

Homalobi.
simplicifolius.
montanus.
detritalis.
Cottoni.
Wingatensis.
Duchesnensis.
Episcopus.
Woodruffi.
junceus.
Kaibensis.
lancearius.
sesquiflorus.
Woodruffi.
Inflati.
Geyeri.
lentiginosus.
pictus.
subcinereus.
lutosus.
pubentissimus.
sabulonum.
Wardi.
Wetherilli.
megacarpus.
oophorus.
Preussii.
ampullarius.
asclepiadoides.
Pattersoni.
sabulosus.
Preussii.
Uliginosi.
Canadensis.

Strigulosi.
Brandegei.
straturensis.
Podo-sclerocarpi.
Rafaelensis.
Argophylli.
amphioxys.
cymboides.
Musiniensi.
pygmæus.
Utahensis.
desperatus.
Mollissimi.
Bigelvoii.
Ocreati.
argillosus.
confertiflorus.
Moc-coppensis.
sophoroides.
Bisulcati.
Haydenianus.
Osterhouti.
Lonchocarpi.
lonchocarpus.
Hamosi.
calycosus.

GREEN RIVER
BASIN.

Homalobi.
simplicifolius.
sericoleucus.
montanus.
junceus.

Inflati.
Geyeri.
lentiginosus.
megacarpus.
Podo-sclerocarpi.
Grayi.
Argophylli.
argophyllus.
Utahensis.
cibarius.
pygmæus.
Ocreati.
confertiflorus.
Hamosi.
calycosus.

GREAT BASIN.

Homalobi.
montanus.
stenophyllus.
Cottoni.
porrectus.
Inflati.
pictus.
Wardi.
Geyeri.
lentiginosus.
oophorus.
Beckwithii.
megacarpus
Preussii.
Pattersoni.

LOWER TEMPERATE LIFE ZONE.

Pacific Slope Division.

Podo-sclerocarpi.
 canonis.
 Serenoi.
 Toanus.
 pterocarpus.
 tetraptirus.
 Casei.

Collini.
 Gibbsii.

Preusii.
 Pattersoni.

Reventi-Arrecti.
 arrectus.

Uliginosi.
 Canadensis.

Atrati.
 atratus.
 Ibapensis.
 obscurus.

Flexuosi.
 pinonis.

Argophylli.
 argophyllus.
 cibarius.
 Eurekensis.
 iodanthus.
 Newberryi.
 Purshii.
 Utahensis.

Malaci.
 malacus.
 Layneæ.

Mollissimi.
 Biglevoii.

Bisulcati.
 Haydenianus.

Lonchocarpi.
 lonchocarpus.

Hamosi.
 Andersoni.
 calycosus.
 sylvaticus.

COLUMBIA BASIN.

Homalobi.
 junceus.
 stenophyllus.

Inflati.
 Geyeri.
 lentiginosus.
 Beckwithii.

Collini.
 Alvordensis.
 collinus.
 Gibbsii.
 speirocarpus.

Podo-sclerocarpi.
 sclerocarpus.

Atrati.
 atratus.

Argophylli.
 argophyllus.
 inflexus.
 Purshii.

Malaci.
 succumbens.

SIERRAS.

Homalobi.
 stenophyllus.

Inflati.
 lentiginosus.
 oocarpus.

Podo-sclerocarpi.
 bicristatus.
 pachypus.

Preussii.
 Preussii.

Argophylli.
 Purshii.

Hamosi.
 Andersoni.
 Bernardinus.

COLORADO RIVER DEATH VALLEY.

Inflati.
 aridus.
 lentiginosus.
 nutans.
 pitcus.
 sabulonum.

Preussii.
 Preussii.

Podo-sclerocarpi.
 tetrapterus.

Argophylli.
 amphioxys.
 coccineus.
 funereus.
 remulcus.

Malaci.
 Layneæ.
 ensiformis.

Lonchocarpi.
 lonchocarpus.

Hamosi.
 calycosus.

Leptocarpi.
 Nuttallianus.

MOGOLLONS.

Homalobi.
 humistratus.
 junceus.
 Wingatensis.

Inflati
 allochorus.
 megacarpus.
 oophorus.
 subcinereus.
 Thunderi.
 triflorus.

Uliginosi.
 Canadensis.

Mollissimi.
 Bigelovii.
 Humboldtii.
 Mathewsii.
 mollissimus.
 Phoenicis.

Argophylli.
 amphioxys.
 argophyllus.
 Newberryi.

Lotiflori.
 accumbens.

Ocreati.
 Moencoppensis.
 sophoroides.
 troglodytes.

Hamosi.
 calycosus.
 Arizonicus.

Strigulosi.
 strigulosus.
 straturensis.
 recurvus.
 Inyoensis.

LOWER TEMPERATE LIFE ZONE.

ARIZONA-MEXICAN DIVISION.

RIO GRANDE VALLEY.	SOUTHERN ARIZONA.	SIERRA MADRE AND SOUTH
Homalobi. humistratus. montanus.	Homalobi. humistratus. Gilensis.	Inflatl. scalaris.
Inflatl. lentiginosus. pictus. subcinereus. triflorus.	Inflatl. Palmeri. Thurberi.	Strigulosi. strigulosi.
Argophylli. amphioxys. Feensis. Shortianus.	Strigulosi. strigulosus.	Mollissimi. Bigelovii. Humboldtii.
Galegiformes. racemosus.	Mollissimi. Bigelovii. Humboldtii.	Galegiformes. racemosus.
Bisulcati. oocalycis.	Micranthi. vaccarum. Hartwegi. hypoxylus.	Micranthi. Goldmani. vaccarum.
Uliginosi. Canadensis.	Hamosi. Arizonicus. nothoxys.	Hartwegi. militaris. Purpusi. Greggii.
Mollissimi. mollissimus. Bigelovii.		Pringlei. parvus. Esperanzae.
Strigulosi. Cobrensis		Chapalanus. hypoxylus. Saxtonis.
		hypoleucus. Seatoni. oxyrhynchus.
		Didymocarpi. diphacus.

TROPICAL LIFE ZONE.

PACIFIC COAST DIVISION.

Homalobi.
Antiselli.

Inflati.
capillipes.
curtipes.
Douglasii.
Hornii.
leucopyllus.
leucopsis.
macrodon.
oxyphysus.

Miguelensis.
Pomonensis.
pychnostachyus.
trichopodus.
vestitus.

Chætodontes.
Brauntoni.

Hamosi.
Traskiæ.
Nevinii.
Bernardinus.

Leptocarpi.
tener.

Micranthi.
Clevelandi.

Didymocarpi.
didymocarpus.
dispermus.
nigrescens.
Breweri.

Pacific Slope Division.

CALIFORNIA
INTERIOR

Inflati.
lentiginosus.
Douglasii.
Hornii.
macrodon.
vestitus.

Hamosi.
tricarinatus.
Bernardinus.

Leptocarpi.
Nuttallianus.
Rattani.
tener.

Didymocarpi.
Breweri.
didymocarpus.
dispermus.
nigrescens.

ST. GEORGE
REGION.

Inflati.
sabulonum.
Geyeri.
lentiginosus.
Lotiflori.
Mohavensis.
Preussii.
Preussii.
Pattersoni.

Argophylli.
tephrodes.
Layneæ.
Zionis.
amphioxys.

Hamosi.
Arizonicus.
triquetrus.

Leptocarpi.
Nuttallianus.

Didymocarpi.
dispermus.

DEATH VALLEY
REGION

Inflati.
aridus.
sabulonum.
lentiginosus.

Atrati.
Panamintensis.
atratus.

Lotiflori.
Mohavensis.

Hamosi.
albens.

Leptocarpi.
Nuttallianus.
teutirostris.

Didymocarpi.
Didymocarpus.
dispermus.

MOJAVE-SALTON

Inflati.
aridus.
Vaseyi.
proriferus.
sabulonum.
lentiginosus.

Lotiflori.
Mohavensis.

Preussii.
limatus.

Hamosi.
albens.

Leptocarpi.
Nuttallianus.
acutirostris.

TROPICAL LIFE ZONE.

ARIZONA-MEXICAN DIVISION.

GILA REGION.

Inflati.
 playanus.
 triflorus.
 lentiginosus.

Leptocarpi.
 Nuttallianus.

Didymocarpi.
 didymocarpus.
 dispermus.

TEXAN REGION.

Mollissimi.
 giganteus.

Leptocarpi.
 Nuttallianus.
 leptocarpus.
 Lindheimeri.
 Wrightii.

Didymocarpi.
 Brazoensis.
 reflexus.

MEXICAN.

Homalobi.
 pasqualensis.
 Pueblæ.
 quinqueflorus.

Inflati.
 Douglasii.
 Julianus.
 lentiginosus.
 leucopsis.
 Magdalænæ.
 proriferus.
 vestitus.
 Hornii.
 insuaris.
 triflorus.

Lotiflori.
 circumdatus.

Strigulosi.
 reptans.
 Rosei.
 Guatamalensis.

Flexuosi.
 Antoninus.

Mollissimi.
 giganteus.
 Humboldtii.
 mollissimus.
 Orizabæ.
 Oranthus.

Galegiformes.
 racemosus.

Hamosi.
 Arizonicus.
 Coahuilæ.
 Greggii.
 Orcuttianus.

Leptocarpi.
 leptocarpus.
 Linnheimeri.
 Nuttallianus.
 nothoxys.
 Francisquetensis.

Micranthi.
 ervoides.
 Luisianus.
 Purpusi.
 Didymocarpi.
 Angelinus.
 diphacus.

EFFECTS OF CERTAIN ECOLOGICAL FACTORS

Certain ecological factors can exist only under certain conditions.

Acidity of the soil is possible only in cool regions where the vegetable humus is very dense, and where the humidity is great and the seasons short and sunshine below normal so far as the Astragaline flora is concerned. The species do not grow under acid Tropical conditions, so far as known. This therefore confines such species to the upper life zones in forests and meadows. These species have slender stems and delicate thin leaves, slender petioles and peduncles and delicate flowers nearly always purple, and seldom large. The pods are uniformly thin and mostly inflated. All the species are perennial with interlaced roots or root crowns and mostly woody crowns.

Alkaline soil is possible only in regions of low humidity, rainfall, and higher temperature and excessive sunshine. Such plants then always grow in the open and mostly on the floor of valleys having no outlets or poor drainage, or on clayey slopes where alkalis are leaching out of saline formations. This is very common in the Great Basin and around the extensive clay deposits of the Tertiary, Cretaceous and Jurassic formations. It also is local throughout the floor of the Tropical life zone. The character of the alkali has much to do with the vegetation. About $\frac{3}{4}$ of 1 per cent active alkalis (carbonates of sodium and potassium) prohibit all growth, while 1.5 per cent of neutral alkalis (sulphates and chlorides of sodium and potassium) only are prohibitive. The Navajo Basin contains more carbonates, and the Great Basin more chlorides and sulphates.

The almost uniform effect of alkalis in Astragalus is to thicken the stems, leaves and flowers, making them coarser, succulent and taller, and reduces the pubescence, but the relative quantity of moisture has a marked effect as in all plants elsewhere. The tendency is also for the flowers to be white and large. Typical alkaline species of the Navajo Basin are *A. asclepiadoides*, *Pattersoni*, and *sabulosus*, and probably *ampullarius*. These all have flat and ample leaf surface. Similar plants of the Mojave-Colorado river region are *A. limatus* and *Preussii*, with flat leaf surfaces, but purple flowers. The Great Basin species where the neutral alkalis are the more abundant are *A. Pattersoni* but with reduced leaf surfaces, but the typical species *A. Toanus*, *Serenoi*, *canonis*, *tetrapterus*, all have greatly reduced leaf surfaces, the leaflets mostly reduced to phyllodia and the stems, petioles and peduncles performing the function of leaves but the plants are tall or long as in the other, the flowers are purple, the pubescence is ashy and sparse. On the other hand the *Homalobi* of the Navajo Basin which grow in soil always somewhat alkaline all have the phyllodia-like leaves of the *Podo-sclerocarpi*. Such species are *A. Episcopus*, *Woodruffi*, *pictus*. They have no corresponding species in the Great Basin. The *Ocreati* of the Navajo Basin develop narrower and more folded and more hairy leaves as the sand in the soil increases and the alkali decreases, such species are *A. confertiflorus*, *agrillosus* and *Moencoppensis*. This follows the general rule. The normal rainfall of the Great Basin is twice that of the Navajo; the normal temperature 2 to 4 degrees less. Strongly alkaline places in the Tropical life zone rarely have perennial species of *Astragalus*. Generally such species are annuals whose roots do not penetrate the surface sands, far, and so the effects of alkalis are not so evident.

The effects of humidity, other things being the same are shown in the Columbia Basin. As we approach the Columbia Basin there is a marked increase in spring and summer humidity though there is less summer rainfall. The winter snows are deeper and the snow cover is permanent through most of the region in the winter months, which is a great protection to the vegetation. There is less alkali. The species of *Astragalus* become more slender and with more woody roots. The *Reventi-Arrecti* and *Collini* prevail; there are some *Atrati*, some *Homalobi*, and *Podo-sclerocarpi*, and a number of *Argophylli*. No species have phyllodia-like leaves, few have broad leaflets and most of these are folded and pubescent. The species are almost exclusively perennial. It is a region of abundant spring flora, particularly grasses.

The northern Plains along the trough of slight rainfall caused by the Rockies has a humidity a little higher than the Columbia Basin and is wind swept throughout the year, and with a low temperature. There is a permanent snow cover except where elevations catch the wind. There is a little alkali. These conditions have produced the densely matted *Homalobi* and *Triphylli* with their scapose peduncles hidden among the leaves and their narrow, thick and silvery leaves and large and densely imbricated stipules. It is only in the bottoms where the snow cover is not disturbed that the slender and variably erect species are found such as the *Bisulcati* and *pectinatus* in alkaline places, the slender *Homalobi*, *Debiles* and *Hypoglotides*.

The interior valley region of California simulates the Arizona-Death Valley region in its Tropical climate and extensive annual flora, and some species are common to both regions, but the higher humidity and winter rains have greatly increased the species and individuals. Here abound the *Didymocarpi*, and *Leptocarpi*. The salt marshes have the annual *A. Hornii* and the remarkable perennial *A. pchnostachyus*. It is a noticeable fact that nearly all Californian *Astragali* have short pubescence closely appressed.

The Coast region of California has a remarkable development of the *Inflati*, along with a few *Hamosi*, in addition to the annuals of the interior region. Its chief characteristics are high temperature, high humidity (due to fogs) and no rainfall except in winter. We therefore find no species with phyllodia, or stems with leaf functions. There is a large development of leaf surface with folded leaflets and slender stems. The *Argophylli* are mostly absent and the *Homalobi* scarce, as are most other groups.

In the Sierra region the *Astragali* are scarce in the forested area. At the north *A. accidens* is found among the bushes, and *Californicus* and *inversus* among the yellow pines. Higher up we find *A. Congdoni*, *Bolanderi* and *Hookerianus*, mostly farther south, but the soil is a very granular granite and not adapted to any vegetation, and so the general flora is meager.

The *Argophylli*, plants of the lower mountain slopes with no permanent winter snow cover, with plenty of spring humidity due to rains or melting snows show a curious distribution. In the Columbia region they develop a loose and cottony pubescence, narrow flowers, and lax stem system. *A. inflexus* even attempts to become erect. The *Argophylli* are normally caespitose and prostrate species. This condition of the Columbia species is manifestly due to higher humidity and light soil. As the group extends south along the Sierras in the impoverished soil the same species become densely matted and often only a few inches across, with very short stems, small leaves and very small flowers and pods. At the foot of the mountains and out on the mesas where it is much hotter and drier but the soil better we have the magnificent *A. coccineus* and *funereus* far surpassing

even *A. inflexus* in beauty and size and with great flowers and pods, and here the *Argophylli* stop short off. These two species seem wholly out of place and yet even extend to the Charleston mountains. One would expect here a jump to some other remarkable allied group but there is none in the whole region. The *Malaci* are the nearest, and seem like hybrids between this group and the *Hamosi*. When we follow the *Argophylli* eastward and then southward we find them varying into the *pygmæus-amphioxys* group, more adapted to the hotter climates, and these seem to have jumped into the *Mollissimi* at the south and the *Sarcocarpi* at the north and east. The *Argophylli* do not extend much into the regions of permanent snow cover, but belong to that trying region of the lower Middle Temperate and Lower Temperate where the snow comes and goes, and thaws alternate with freezes so that all stems persisting over winter must be closely protected by matting, by dead leaves and petioles and by dense stipules and wool or hair and short internodes.

The *Sarcocarpi* have passed up into the region of permanent winter snow cover for the most part at the north and do not show this adaptation, but the southern species do.

The *Mollissimi* are protected more against heat by their shaggy covering, but in the far south *A. Humboldtii* and others have only the close silvery pubescence, and even that is often sparse.

The effects of heat are best shown in the Tropical life zone where plants have been compelled to adopt the most effective system, better than phyllodia, the destruction of the perennial root. This requires no winter protection, or devices against continued droughts but could obtain only where the resting period is one of drought and not cold, otherwise the seeds would rot. The annual habit results in slender stems, small leaves, flowers and pods, the latter with thin walls. For this reason we have the *Didymocarpi* and *Leptocarpi* the prevailing species, along with a smattering of *Inflati*, and other groups. In the few perennials which persist in favorable places there is the same leaf, flower and stem reduction and absence of phyllodia, though here and there a few like *pictus* and some *Homalobi* persist.

The presence of a poison, in most of the species, affecting the motor nerves makes the genus of no economic importance as very few are eaten at all by animals, while some species destroy many horses and sheep. *A. Coltoni* is poisonous to hogs in the La Sal region of Utah. *A. mollissimus* is the loco *Astragalus* of the Plains. *A. Canadensis* has poisoned sheep in Montana. Various forms of *A. lentiginosus* have a bad reputation in southern Utah. No *Astragali* are voluntarily eaten by animals, but in the spring, when animals are ravenous for the first green things that come out of the ground they will bite at anything and it is at such times that they are poisoned. Once poisoned they get a craving for them and become "locoed" (crazy). when the range is all eaten off but these plants sheep will eat them rather than starve and it is in this way that they get poisoned.

COLOR OF THE FLOWERS AS REGARDS ALKALINITY.

Practically all the pink or pink-purple flowers on drying, become bluish, exceptions to this are *A. coccineus* and sometimes *funereus*. The reason for this is that the papers in which the plants are dried contain alkali and this neutralizes the acid of the red tints and turns it alkaline which then becomes blue. Whenever this is the case the natural color can be restored by moistening the flower by a dilute acid. As has already been said the soil of the entire west is alkaline south vary somewhat in the tendency to turn blue. *A. coccineus*

except regions at the north in meadows and deep forests where there is much humus, and at the south only in moist meadows at high elevations. There seems to be no causative connection between red-tinted flowers and the soil as to acidity or alkalinity in the soil. All such flowers at the north turn bluish on drying in ordinary paper. The white flowers have less yellow in them at the north. There are very few creamed-colored flowers at the north. From southern Idaho and Oregon to Mexico the white flowers are never pure white, or rarely so in *A. Pattersoni*, but variably cream-colored but never yellow. This indicates alkalinity. The red-tinted species at the south vary somewhat in the tendency to turn blue. *A. coccineus* remains bright red on drying, but its nearest relative *A. funereus* and *Utahensis* either remain red or turn blue on drying which indicates acidity in the flowers part of the time. Many of the red tinted flowers are brilliant pink, such as *A. funereus*, *Utahensis*, *Toanus*, *Woodruffi*, *Preussii*, *amphioxys*, *Bigelovii*, *Zionis*, and they all turn bluish-purple on drying, and are therefore acid when in bloom and all grow on decidedly alkaline soil. Practically all the species of the Arizona-Mexican region (mostly Tropical) are either white or dull bluish which would indicate an alkaline condition of the soil. The same is mostly true of the California Tropical region. On the other hand many species of *Asiragalus* growing in humus and presumably acid soils are bluish such as *agrestis*, *crassicarpus*, *elegans*, *Bourgovii*, *argophyllus*, *simplicifolius*, *montanus*, *debilis*, *andinus*, etc. Iron in the soil seems to heighten the colors. Lime is almost everywhere at the north as limestone, but is at best a neutral alkali and not active as are those of the Great Basin and the south.

TOPOGRAPHY.

The map published with this shows the topography of the United States. The British American portion of North America is the same continuation of low elevations on the east, spruce forests of the Upper Temperate life zone, to the Arctic.

The region east of the mountains in Alberta is a continuation of the Montana Plains region to the Saskatchewan, thence northward is the Spruce region to the Arctic.

West of the Plains there is a low valley here and there which has the Middle Temperate flora, particularly the branches of the Columbia, and the Fraser river region. All else is Upper Temperate, with the alpine on all the ranges of mountains.

The Mexican region is a continuation of the Arizona floor at about 2000 to 3000 feet altitude nearly to Mexico City. On the western edge of the floor about in a line south of Tucson Arizona to Deming New Mexico the floor rises into a vast plateau from 6000 to 8000 feet altitude and about 30 miles wide and 300 miles long, called the Sierra Madre mountains. West of this the country breaks down into immense barrances or canons to the sea and with a Tropical climate. This barranca condition of the west slope continues nearly throughout Mexico southward at least beyond Colima. East of the Sierra Madre Plateau from the floor of the country rise scattered and low ranges of mountains in Coahuila San Luis Potosi etc. to the Gulf of Mexico water shed. This whole region is a very hot and barren country with very little rainfall. In the Zacatecas region it rises to 8000 feet altitude but with little change in the vegetation. South of Zacatecas it drops down again and a wide area of desert runs out to Guadalajara. South

of this the region is a network of ranges and volcanic peaks where the Tropical vegetation reaches 8000 feet altitude, and the peaks sometimes reach the Lower Temperate, but rarely they extend higher to the Middle Temperate, and only very rarely as on Orizaba, Popocatepetl, and Mt. Colima do they reach the alpine. The lowlands about Colima and Tampico southward have the dense vegetation and summer rains of the humid Tropics. This is about as far as species of *Astragalus* extend except a very few. The plateau floor from Arizona southward is Tropical. Lower California has a low range of mountains the entire length but the flora rarely gets up out of the Tropical. San Pedro Martir is an exception.

The upper limits of the Tropical in the United States rarely reaches 3000 feet altitude. In the Arizona region they are about 4000 feet, and rise as you go southward.

The upper limits of the Lower Temperate life zone reach about 5000 feet in the Great Basin, but drop to about 1000 feet in the Columbia Basin. In the south in Arizona they often reach 8000 feet altitude.

Topographical details can be worked out on the map, and the general zonal limits are best seen there.

NOMENCLATURE.

It has been my plan to make as few changes in names as possible. The Vienna Code has been followed in the main and therefore the oldest published name has been retained, except the meaningless *Astragalus astragalinus*, for which I have substituted the *A. andinus* of Nuttall. It is however my judgment that the Grayan method of retaining the oldest name in the genus is better and productive of little confusion, while the present method produces endless confusion. I do not adopt the dictum "Once a synonym always a synonym," but I have used the name of a species even if the same name has been used for a species before that was a synonym of some earlier species, or belonged to another genus. I have rejected Greene's substitutes for Sheldon's hybrid names, for the reason that if we reject hybrid names we shall have to go much farther back than Sheldon.

I retain *Astragalus* for the reason that it is the earliest name and the one generally accepted by the botanical World. The fact that it is preceded in the *Species Plantarum* by *Phaca* should not require the rejection of the genus, for the genus was proposed by Tournefort and retained by Linnæus in his *Systema* before *Phaca* was created.

Priority is the only true basis for nomenclatural stability but no one however zealous an adherent of this dictum accepts it without the narrowest limitations. If we could ever know what was the true priority in each case it would require the renaming of almost every genus and species in the world as I have already pointed out. This being out of the question the next thing is the general consent of botanists. This has crystallized so that at the present time there is a general assent to main points, which is that old names shall not be changed on a technicality, and that in other respects 1753 shall be the beginning date of nomenclature. The exceptions of the Vienna Code cover most of the desirable reservations from the strict application of priority. There should be certain other exceptions of genera. There should be the abrogation of the rule about Latin descriptions, and the rejection of all genera proposed in early days that were not accompanied by species. This will rule out the genera of Adanson, Necker, and others, unless they were provided with species by others before any other generic names were proposed for them.

KEYS.

The keys are constructed in the usual way, and indented in the same way. In addition the system of Capital letters is used to prevent any confusion (which often occurs in the old way). The letter "A" represents the first section of each main group such as the Homalobi. Each succeeding "A" represents a co-relative section of the same group. The letter "B" stands for the first subsection of "A", and every other "B" stands in the same relation, and so on with every letter used, each one is subsidiary to the letter which precedes it in the alphabet. 5A6B3C2D represents the second division of the third division of the sixth division of the fifth division of the main group.

ARTIFICIAL KEY TO ASTRAGALUS GROUPS.

- A.** Pods wholly 1-celled and without any intrusion within the cell of either suture, but pods may be grooved at either suture.
- AB.** Pods narrow or small, the cross section not over 4 mm. long, neither inflated nor fleshy.
- ABC.** Pods narrow, mostly laterally flattened. 1. Homalobi.
- AB2C.** Pods oblong to oval, obcompressed and bisulcate ventrally.
- Pods erect and sessile 23. Ocreati
- Pods pendent and stipitate 24. Bisulcati.
- AB3C.** Pods short and broad, inclined to be obliquely ovate, seldom longer than calyx, mostly rigid.
- Walls rigid, Plants mostly caespitose or acaulescent and densely tufted.
- Flowers not large. 1. Homalobi.
- Flowers large and white. Pods shorter than calyx 2. Triphylli.
- Walls not rigid (except in leptaleus). Stems slender and weak.
- Annuals A. quinqueflorus.
- Perennials growing in damp meadows. 3. Debiles.
- A2B.** Pods narrow and large, stipitate, mostly curved, not inflated, fleshy or with rigid walls, with cross section over 4 mm. long. Some forms of *A. humistratus* might come here.
- Flowers ochroleucous with woolly calyx, stubby, many. 7. Collini.
- Flowers mostly purple, more scattered, without woolly calyx. 10. Reventi-Arrecti.
- A3B.** Pods broad, narrow in *flexuosus*, etc., inclined to be inflated and mottled and with short and spreading pubescence at least on the leaves, firm but not fleshy, Flowers purple and mostly small. Stems slender and tufted. 17. Flexuosi.
- A4B.** Pods broad and very fleshy, or narrowed at tips and winged or angled. 8. Podo-sclerocarpi.
- 2A.** Pods incompletely 2-celled by one or both sutures being reised as a ridge or partial partition within.

- 2AB. Dorsal suture neither raised nor intruded. Ventral suture produced somewhat along the middle. Pods inflated and with papery walls (rarely leathery in *A. lentiginosus*) 4. Inflati.
- 2A2B. Dorsal suture, either a raised line within or slightly produced, the ventral seldom produced.
- 2A2BC. Walls almost papery, pods slightly inflated.
 Pods sessile. 5. Sparsiflori.
 Pods stipitate and mostly pendent. 6. Alpini
- 2A2B2C. Walls rigid or a little fleshy. Pods mostly stipitate.
 Pods ascending to erect, abruptly if at all pointed below. 10. Reventi-Arrecti.
 Pods pendent, tapering below, explanate with age. 26. Lonchocarpi.
- 2A2B3C. Pods sessile, rarely inflated, oblong to broadly-ovate, oblique. Dorsal suture a raised line only within. Walls variably fleshy, mostly hairy or woolly without. Flowers purple, rarely white, mostly large. Plants caespitose, acaulescent, or pulpy with short stems, never erect. 18. Argophylli.
- 2A2B4C. Dorsal suture a raised ridge within. Pods mostly stipitate, broad to round, inflated, with rigid walls not hairy when mature, variably fleshy. Flowers large. Stems erect mostly. Leaflets broad. 9. Preussii.
- 3A. Pods wholly or nearly 2-celled by intrusion of sutures.
- 3AB. Pods with dorsal suture intruded to or near the middle, the ventral not intruded to speak of.
- 3ABC. Pods seemingly wrong side up by the ventral suture being the more arched.
 Pods rigid, rarely fleshy or papery, not inflated, mostly pendent, slightly if at all stipitate. oblong or narrower, as broad as high.
 Flower scattered and small. 15. Atrati.
 Flowers large and densely spicate. Pods nearly linear.
 Leaflets broad and flat, many 25. Galegiformes.
 Leaflets very narrow and few. 26. Lonchocarpi.
- Pods papery, inclined to be a little inflated, stipitate, mostly pendent. (*A. scopulorum* and *racemosus*.) 16. Strigulosi.
- Pods a little fleshy and inclined to be a little inflated, ascending in dense spike on tall stems. Flowers white. 11. Uliginosi.

3AB2C. Pods with ventral suture not the more arched rather fleshy.

Flowers not small, many.

Pods erect or ascending. Flowers large.

Flowers purple. Pods linear to narrowly oblong, reniform to elliptical in cross section, nearly straight. 19. Malaci.

Flowers white or cream-colored. Pods curved, linear, triquetrous in cross section, smooth.

20. Succumbens.

Pods pendulous, narrow. Flowers white or cream-colored.

Pods not long-tapering below. 25. Galegiformes.

Pods long-tapering below. 26. Lonchocarpi.

Pods spreading, rarely erect, broad and thick, mostly very fleshy. Leaflets long narrow and few.

Stems coarse. 8. Podo-sclerocarpi.

Flowers small. Pods spreading. Low plants.

14. Lotiflori.

3A2B. Pods wholly 2-celled except at tip. Both sutures variously intruded.

Pods inflated, mostly papery, not small, not shaggy.

Pods spherical to oval. Stems very slender.

A. platytropis.

Pods oval to ovate, oblique. Stems not delicate.

Pods sessile. A. lentiginosus.

Pods stipitate. A. Bolanderi and vallis.

Pods somewhat to not at all inflated.

Pods not small, rarely narrow, not triquetrous.

Pods plum-shaped and very fleshy.

Pods sessile. 22. Sarcocarpi.

Pods stipitate. A. accidens. 2164

Pods oblong and oblique, fleshy, stipitate.

A. pachypus.

Pods narrowly oblong to oval, leathery, inclined to be shaggy or leaves shaggy. 21. Mollissimi.

Pods small or narrow, triquetrous to didymous in cross section.

Pods triquetrous in cross section, rarely reniform, mostly narrow and curved, mostly reflexed.

- Perennials. Flowers not very small.**
- Flowers very large. **A. succumbens.**
- Flowers medium-sized. Northern plants.
(**A. nitidus.**) **27. Hamosi.**
- Flowers very small, mostly Mexican.
29. Micranthi.
- Annuals.** **28. Leptocarpi.**
- Pods didymous to reniform, cross-ribbed small.
- Perennials.**
- Flowers and fruit in dense heads.
12. Hypoglottides.
- Flowers and fruit in spikes.
13. Chaetodontes.
- Annuals.** **30. Didymocarpi.**

HOMALOBI.

Pods wholly 1-celled, with rib-like sutures which are neither conspicuously raised as sharp edges nor intruded as partitions, splitting along both sutures from the tip, (from the base in *A. stenophyllus*), rarely sulcate dorsally, not at all ventrally, with walls papery to thin-coriaceous, rarely a little inflated, with body linear to oblanceolate or rarely narrowly oblong to half-oval. Flowers racemose, rarely capitate. Perennials (*A. quinqueflorus* is annual.)

☞ The synonymy in the text is much abbreviated to avoid packing the descriptions with useless matter. Complete synonymy is given in the Index where all names are found under the recognized species to which they belong. Abbreviated cross references are given under generic synonyms simply to aid in finding the correct name.

Key

- A. Pods papery, reflexed, with sutures thicker than the walls (not evidently so in the *stenophyllus* group), not sulcate, normally completely laterally flattened when immature and mostly so when ripe, abruptly apiculate, with suture the more arched except rarely in *A. stenophyllus*, narrowed below. Pedicels not twisted.
- AB. Calyx almost turbinate, 1-2 mm. long, the slender teeth at least half as long as but little longer than tube. Stipules conspicuously connate. Foliage inclined to blacken on drying. Weak, much branched, and very slender plants with small and purplish (rarely whitish) flowers. Leaflets long-petiolulate acute at base and narrowed. Pods almost sessile or on a stipe not much longer than calyx, narrowly oblong to half-oval, with the sutures prominent.
- ABC. Calyx teeth decidedly shorter than the tube. Ribs of pods conspicuous. Peduncles elongated and subterminal and with the rachis often a foot long. Leaflets distant, mostly folded and rather thick, but really oblong, seemingly linear. Leaves never sessile. Perennials of dry and open mountain slopes in Lower Temperate Life zone. *Tenelli*.
- 1 *Wingatensis*.
2 *tenellus*.
- AB2C. Calyx teeth longer than the tube and unequal, tube about 2 mm. long. Pods short-oblong to half-oval, ashy, inflated and cross-section deltoid-ovate, not 1 cm. long (about 8 mm.) 3-5 mm. high, about sessile. Ventral suture nearly straight, the dorsal much arched. Flowers purplish, ascending, 5-7 mm. long, in short racemes on short and filiform peduncles which are much shorter than the leaves and solitary and axillary nearly throughout. Leaves all petioled, rarely 6 cm. long. Leaflets nearly linear and acutish at both ends to narrowly elliptical and obtuse, thin, nearly 2 cm. long. Pubescence ashy throughout. *A. pauciflorus* and *miser* might be sought here as they are near relatives but because of much inflated pods and ventral suture being less arched they are placed in the inflati.

A2B. Calyx short-cylindrical to almost campanulate, teeth shorter than the tube and mostly very short. Pods inclined to be larger above and tapering into a long and filiform stipe at base, acute at tip, very flat, about straight, 2-4 cm. long exclusive of the stipe, smooth. Flowers fully 1 cm. long. Leaflets distant, 1-2 cm. long, mostly acute and mostly linear. Peduncles elongated and subterminal.

A2BC. Flowers bright pink-purple, few. Stipules connate below. Calyx teeth rather narrow. Pods opening first at tip.

3 Coltoni.

A2B2C. Flowers ochroleucous or white, rather many. Calyx teeth broad and mostly deltoid. Lower rib of the pod a mere line and inconspicuous. Stipes capillary. Peduncles slender. Pedicels slender, 2-4 times as long as bracts. Stems erect and branching above, 2-3 ft. high. Leaflets 7-15 pairs, long-petiolulate. Upper leaves about sessile, the lower short-petioled, spreading. Leaf rachis conspicuously tapering.

4 stenophyllus.

5 Antiselli.

2A. Pods not papery, rather rigid and almost leathery, rarely narrower below than at tip, with sutures not conspicuously thickened, though evident and acuminate at tip.

2AB. Pods conspicuously stipitate. This group seems to connect with the Podo-sclerocarpi, but is equally as near as the Homalobi

2ABC. Pods erect, conspicuously laterally flattened. Leaflets nearly round, leathery, broadly cuneate below. Whole plant smooth except for a few hairs on the calyx.

6 porrectus.

2AB2C. Pods long-stipitate, acuminate at both ends, linear, reflexed or widely spreading, mottled, the body 3-4 cm. long, 3-5 mm. wide, much laterally flattened, the ventral suture the more arched and pod inclined to be recurved. Rather straggling, slender plants 2-3 ft. long. Pedicels not twisted though pods appear upside down. Inversi.

7 Californicus.

8 inversus.

2A2B. Pods narrow, mostly sessile or with a minute stipe, mostly linear or oblanceolate, sharply acute, ending in a filiform tip, when young flat and knife-like and inclined to be larger above (not so in *Episcopus* and normally in most forms of *junceus*), when mature flat at tip and also flat at base (except in forms of *junceus*), the middle section being obovate elliptical (flat in *Episcopus*) or rarely cordate when sulcate in one form of *campestris*, mostly narrowed into the calyx, tip nearly always declined, the ventral suture normally more arched (convex) than dorsal at least toward the tip of pod but seeming less so because of the twisted pedicel which brings the pod wrong side up, rarely in forms of *junceus* the pods are falcate upwards and with ventral suture concave. Pods racemose, widely spreading or reflexed smooth when mature. Flowers capitate rarely, mostly racemose, widely spreading or reflexed, rather greenish white with the keel purple-tipped and sometimes the banner, short and stubby, rarely 1 cm. long. Bracts short and sharp, rarely as long as pedicels in fruit. Keel greatly incurved. Slender plants growing in tufts from slender crown-branches from tap root, mostly low and weak. Leaves narrow with rather distant leaflets and with the slender petiole mostly as long as the rachis, or the leaflets rudimentary or absent from the rush-like rachis. *Campestris*.

2A2BC. Pods wider above, conspicuously flattened laterally except in the middle, the valves twisting at maturity and opening at tip and to base. Banner erect, oblong. Keel erect and mostly produced and very sharp. Calyx teeth very sharp and mostly subulate. Leaves never all filiform. Stems rarely wiry.

9 campestris.

2A2B2C. Pods mostly about the same width from tip to base, about flat when ripe (conspicuously flattened when young, and round in cross-section when ripe in *A. junceus*), not noticeably sulcate. Leaflets mostly like the rachis, that is round, filiform and sulcate, 1-2 pairs, rarely some are flattened a little or the rachis flattened and enlarged toward the tip and phyllodium-like, rarely jointed to rachis. Stems wiry and rush-like, widely branching, open, erect, green. Peduncles, stems and leaves about all alike and tapering. Flowers and pods in loose racemes and pods reflexed, except in *A. Woodruffi*. Inflorescence longer than the elongated leaves. Stipules thick, green, with a broad base, not connate. Mostly tufted plants about 2 feet high.

2A2B2CD. Proper peduncles shorter than the leaves. Calyx teeth minute and blunt. Stipules narrow. Pedicels about four times the bracts. Bracts minute, triangular.

10 junceus.

11 Episcopus.

2A2B2C2D. Pedicels not longer than the bracts, 2-4 mm. long. Calyx teeth subulate, at least one third to a half the tube in length, reddish. Peduncles much longer than the leaves.

12 lancearius.

13 Woodruffi.

2A2B3C. Pods about the same width throughout, linear, abruptly acute, little compressed, straight or nearly so, slightly sulcate dorsally. Calyx teeth subulate, longer than the tube. Leaflets linear-oblongate, not like the rachis, not opposite, 3-6 pairs. Peduncles axillary, short. Pods reflexed in racemes longer than the peduncles. Bracts and stipules minute.

13a pasqualensis.

3A. Cæspitose or acaulescent plants with small and mostly arched, short and stubby flowers with short claws, rarely 9 mm. long (1.5 cm. long in *detritalis*), single to few, mostly racemose, rarely capitate, sessile or short-pedicelled. Calyx campanulate (rarely cylindrical in *detritalis*) and short, with the mostly short teeth not longer than the tube. Peduncles none or short, long in *A. Gilensis* and *quinqueflorus*. Pods small, sessile, not wider above, little longer than calyx, mostly laterally flattened, oblique, chartaceous, or thinly coriaceous never erect, even the flowers mostly reflexed, the ventral suture normally concave, rarely convex. Seeds single or few. Stipules large, (small in *A. quinqueflorus*) sheathing or rarely free, mostly long-hairy below. Pedicels not twisted. Pubescence mostly closely appressed and silvery.

3AB. Leaflets with sharp needle-like tips. Pubescence attached by the middle or not at the end (except in the var. *tegetarius*). The terminal leaflet at least not joined to the rachis (except in *detritalis*). Flowers purple. Keel tip not produced.

3ABC. Acaulescent and cæspitose plants. Flowers on evident peduncles. Leaflets when present placed at the ends of the evident petioles. Bracts large and hyaline. Pods linear to ovate, not sulcate, about 1 cm. long (longer in *detritalis*), very sharp-pointed. Ventral suture straight or concave, sometimes convex at tip. Leaflets flat.

14 simplicifolius.

15 detritalis.

3AB2C. Kentrophyti. Cæspitose and prostrate plants. (one variety erect) with densely matted stems which are mostly very slender and with very short internodes, mostly longer than the stipules. Flowers nearly sessile among the leaves, blooming throughout the summer, reflexed as well as the pods. Bracts minute, shorter than the pedicels. Leaves very short or with no petiole, the whole rarely 2 cm. long. Leaflets folded, elliptical to nearly linear, acuminate and acerose not jointed to the rachis, with thick midrib, 2-3 pairs. Flowers very small and very much arched and hooded. Pods rarely over 4 mm. long, claw like, ovate or broadly oblong, rarely twice the calyx, about 1-seeded. This group connects directly with the Humistrati.

16 montanus.

3A2B. Cæspitose or decumbent and widely spreading. Plants with slender stems when less condensed, and mostly with internodes many times longer than stipules. Stipules large, connate, hyaline. Flowers small and stubby on conspicuous short pedicels, inclined to be subracemose, ascending to horizontal, with conspicuous and subulate (rarely ovate) bracts which are much longer than pedicels. Keel tip triangular and sharp. Leaves with conspicuous petioles when leaflets are less than 5 pairs. Leaflets 3-10 pairs, close-set (more distant in *A. humistratus* var. *tenerrimus*) flat or rarely folded, all jointed to rachis not acerose nor with thick midrib, with hairs not attached at the end but closely appressed and straight. Bracts elongated. Pods conspicuously lunate or ovate or falcate-oblong and abruptly contracted at tip to a long and acicular point, much longer than calyx, 1-2 cm. long, mostly conspicuously compressed laterally and with cross section obovate to obcordate chartaceous, nearly smooth, mostly sulcate dorsally to the middle but not at tip or base, cavity larger than the seeds and a little inflated, few-seeded. Plants blooming all summer. Humistrati.

17 humistratus.

18 sesquiflorus.

Pods minute or seldom as long as calyx, one seeded, never 1 cm. long, elliptical to ovate. Leaves with slender petioles, hairy with closely appressed and straight hairs.

3A3B. Cæspitose and acaulescent plants or with stems with internodes not longer than the large, connate, hyaline, hairy and imbricated stipules. Leaflets obtuse. Bracts relatively large, about equaling the calyx, longer than the pedicel in *humillimus*. Pubescence not attached at the end except in *A. troglodytes*.

3A3BC. Leaflets 3-8 pairs, elliptical to oval, mostly flat. Peduncles conspicuous. Humillimi.

3A3BCD. Flowers single to very few, not over 5 mm. long.

19 humillimus.

3A3BC2D. Flowers 10 or more in heads or spikes on very short pedicels and with long-triangular bracts about equaling the calyx. Peduncles conspicuously longer than the leaves (about twice as long) and ascending or erect, relatively stout. Crowns few and large, woody. Leaves narrow, about 1 dm. long, with 6-10 pairs of elliptical flat, leaflets 5-10 mm. long and contiguous. Pods somewhat longer than the calyx and splitting it. Flowers not less than 5 mm. long. Calyx teeth about or a little more than half the tube which is obliquely conic and 3-4 mm. long and spreading.

20 Gilensis.

3A3B2C. Leaflets digitate and mostly a single pair, oblanceolate and apiculate, never minute. Stems caespitose often a mere crown, always with overlapping stipules which are very shaggy with long hairs. Flowers purple. Plants blooming early.

21 sericoleucus.

3A4B. Stems caespitose, very many, prostrate, very slender with internodes much longer than the large and not connate stipules. Flowers white, small in axillary heads. Pods oval-ovate, about 4 mm. long. Leaflets very small and nearly round.

22 tegetarioides.

3A5B. Slender plants, apparently winter annuals, with ascending to prostrate stems a few inches long from the crown of a slender root. Flowers racemose, few. Pods chartaceous, a little inflated about 7 mm. long, with ventral suture conspicuously arched and dorsal straight. Leaflets linear. Peduncles elongated. It is possible that this belongs in the *Inflati*, but at present I place it here.

23 quinqueflorus.

1. *Astragalus Wingatensis* Watson Proc. Am. Acad. 18 192 (1883) *Homalobus* Rydberg. Pods straight, but oblique, narrowly oblong, flat in the type, about 15 mm. long and 3 mm. high, smooth and inclined to be mottled, the dorsal suture only a little convex and the declined tip nearly in line with it, seeds 3 or more maturing. Flowers 10-20 in a long and very open raceme, erect or spreading, 5-7 mm. long. Banner abruptly arched at calyx tips to 45 to 100 degrees, 3-4 mm. long and 3 mm. wide, about 2-4 mm. longer than keel, broadly ovate to oval deeply notched, purple-veined. Wings oblong, 3-4 mm. long, entire, about about 2 mm. longer than keel and appearing as if as long as banner by its being arched back, ascending or much arched, flat to keel. Keel very blunt, the tip much incurved and rounded, purple-tipped, surpassing the calyx teeth by about 2 mm. the tip oval, about 2 mm. wide, base straight. Calyx nigrescent, tube about 2 mm. long and the teeth about 1 mm. long and broadly triangular to filiform and about equal. Pedicels 1-3 mm. long, slender. Bracts small but evident, persistent, hyaline. Peduncles grooved, subterminal, 7-14 cm. long or more including the rachis which is about 2-3 times the whole, longer than the leaves, filiform and tapering, erect. Leaves never sessile, 2.5-7 cm. long. Leaflets 3-6 pairs, distant, on small plants 4-10 mm. long, on larger ones 2-3 cm. long, elliptical to linear, distant, truncate to notched, mostly folded and rather thick. Stipules with the free tips triangular in the upper axils. Stems widely spreading and not densely branched, often 2 ft. long, from a thick woody root, several, sparsely leafy. Whole plant except the pods minutely pubescent, the hairs very wide, warty, flat, sparse. From Mounds Utah to Glenwood Springs Colorado and southward in the Navajo Basin to Fort Wingate New Mexico. It blooms in May, and grows on open and dry rocky slopes and ledges among the junipers. Lower Temperate life zone.

Astragalus Wingatensis var. *Dodgeanus* (Jones Zoe 3 289 (1893) as species). *A. acerbus* Sheldon and *A. proximus* Rydberg, *Homalobus Clementis* Rydberg. This is a stipitate-podded, form, often nearly round in cross section, and with flowers about 5 mm. long and white. The leaflets mostly linear to rudimentary and stems very slender. From Thompson's Springs Utah to Glenwood Springs and Salida Colorado. Same life zone.

2. *Astragalus tenellus* Pursh Fl. 473 (1814). *A. multiflorus* (Pursh) Gray. *Ervum multiflorum* Pursh, *Tragacantha* Kuntze. *Orobis dispar* Nutt. *Phaca nigrescens* Hook., *A. nigrescens* (Hook.)

Gray, *Homalobus* Britton. Pods 1-2 cm. long, 3-4 mm. high, normally very flat but often nearly round in cross-section in the middle, abruptly contracted at both ends, stipitate and with stipe often twice the tube, mostly speckled, smooth and shining, from nearly oval to narrowly oblong, with sutures equally arched or the dorsal concave and with pod seemingly recurved a little but with tip in line with the dorsal suture. Seeds rarely more than one maturing. Flowers normally white, rarely purplish, 5-8 mm. long, ascending. Banner oval to oblong-ovate, abruptly arched at end of calyx tube to 45 to 90 degrees, with sides reflexed 1 mm. wide below but not at all at tip which is barely notched; groove very shallow at base and forming a half circle but reduced above to a broad arc about 2 mm. wide and then narrowed to tip, pink-purple-veined, inclined to be faintly colored from 3 mm. below tip; white spot obovate and sparsely veined, with blade swelled a little near base. Wings obliquely lanceolate-oblong and about half of an ellipse, entire, from flat to concave to keel to within 1 mm. of tip and then concave beyond, the left hand one flaring and the other straight, 1-2 mm. longer than keel, 1 mm. wide, white. Keel rounded to over 90 degrees and purple tipped, the tip inclined to be truncate, about straight, surpassing calyx by 2 mm. Calyx *Hedeoma*-like and a little obcompressed at tip, 1 mm. wide, nearly 2 mm. long, lower teeth longer, setaceous, with rounded sinuses fully and not longer than the tube. Pedicels about 1-2 mm. long, slender. Bracts normally double the pedicels but sometimes short. Proper peduncles very short, inclined to be in pairs in all but the lowest axils, one almost none and the other 1-2 cm. long, the floral rachis short to 1 dm. long and scatteringly flowered. Leaves 3-8 cm. long, nearly always closely sessile except below. Leaflets 6-19 pairs, flat, rarely 2.5 cm. long, thin, 3-5 mm. wide, narrowly elliptical, some nearly linear, mostly nearly contiguous. Stems a foot or two long, densely tufted and densely branched, not filiform, weakly ascending, with internodes rarely 7 cm. long and densely leafy. Smooth plants inclined to dry black. Rather common in shady places and woods from the Saskatchewan and the Mackenzie rivers to Minnesota and Nebraska and southward to New Mexico, westward throughout Colorado and Utah to Central Nevada East Humboldt Mts. Nevada and northward. Also on river bottoms in Nebraska. Middle Temperate life zone. Some forms approach *A. Bourgovii*.

3. *Astragalus Coltoni* Jones Cont. 2 237 (1891). Pods in the type linear to narrowly oblanceolate, triangular at tip, 3-4 mm. high and 3-4 cm. long. Stipe 2-3 times the calyx. Flowers about 1-1.5 cm. long, ascending. Banner about a half longer than keel, about 8 mm. long, oval, arched abruptly beyond calyx to 45 degrees, with sides reflexed somewhat. Wings about 1 mm. wide, nearly straight, about 2 mm longer than keel and much narrower, light-colored. Keel about 5 mm. long, straight or nearly so, the tip abruptly erect or a little more and acute or turned out a trifle and triangular, purple, about 3 mm. high. Calyx tube about 5 mm. long and 3 mm. high, a little oblique at tip, a trifle narrower below and truncate and attached on lower corner to a black-hairy and stout reflexed pedicel about 1 mm. long which is about equaled by the minute bract, nigrescent. Teeth in the type minute, triangular. Peduncles very stout for the plant and strict and deeply sulcate, about as thick as the stems, often a foot long. Leaves about 1 dm. long, with tapering and rigid and green rachis. Leaflets very distant about 3 (3-5) pairs, linear, obtuse, 1-2 cm. long, sometimes absent altogether, the terminal one simply the enlarged tip of rachis and not jointed to it, ashy when young. Lower stipules connate and scarious, the upper triangular, small, green, variously connate or free. Proper

stems very short and flexuous, ascending, slender, densely tufted, many, branched below, sulcate and green like the peduncles and leaves. Roots thick and woody. Grows on gravelly mesas and canons in open places where it is very dry. Blooms in May. Throughout the northern part of the Navajo Basin and as far east as Grand Junction Colorado. Rare outside of the Navajo Basin. . Also on the upper Sevier river at Vermilion Utah and in Tintic Valley near Mammoth. Lower Temperate life zone.

Astragalus Coltoni var. Moabensis Jones Cont. 8 11 (1898). a foot high, leafy, the leaflets all jointed to rachis and elliptical to linear. Pods obliquely linear-elliptical, about 2 cm. long and 4 mm. high, rather abruptly contracted at both ends, with stipe about as long as calyx or twice as long. Flowers brilliant-purple, with elongated banner. Calyx teeth 2 mm long. Moab and Westwater Utah. First collected by Miss Eastwood. Very common in the lower edge of the Middle Temperate life zone on the La Sals in the sagebrush. Poisonous to hogs.

Astragalus Coltoni var. aphyllus n. var. Leaflets none, the whole plant a mass of filiform and tapering leaf rachises. Richfield Utah in the red sandstone cliffs. A connecting form in the San Rafael Swell.

4. **Astragalus stenophyllus** T. & G. Fl. 1 329 (1838). *A. filipes* Gray *A. leptophyllus* Nutt., *Phaca* Piper, *Homalobus* Rydberg. Pods 1.2-4 cm. long. 4-6 mm. high, broadly linear, width about equal throughout, triangular at both ends, or rarely acuminate, delicately reticulated but chiefly so in the middle, with cross-section diamond-shaped to ovate when fresh and with both sutures raised externally and not at all produced within, about straight and a little oblique, opening first at base and with stipe dividing; sutures equally arched. Stipe 2-4 times the calyx. Pods generally pendent but sometimes horizontal. Flowers about 1-1.5 cm. long, loosely racemose, ascending, with exserted claws, light-cream-colored. Banner short, arched to 45 to 90 degrees 2 mm. beyond calyx teeth, triangular-ovate to oblong, 7-10 mm. longer than keel, expanded and thickened at base as in *A. Beckwithii*, acutely notched, sides reflexed a little, groove very shallow broadly v-shaped, about 2 mm. wide, a little wider below. Wings obovate to lanceolate, ascending 45 degrees and exposing base of keel, concave to keel, entire or obscurely toothed at the rounded tip, 1-3 mm. longer than keel and nearly as long as banner. Keel with straight base and tip sharply rounded to a half circle and the blunt end pointing inward, about 3 mm. high, yellow. Calyx about 3 mm. wide and 4 mm. long, almost campanulate, nearly equally inserted at the acutish fleshy base, greenish-white, oblique at tip and cleft deeper above and with broad sinuses and minute deltoid blackish teeth. Pedicels 2-7 mm. long, mostly filiform, much longer than the minute hyaline ovate bracts. Peduncles 2-3 dm. long, much longer than the leaves, barely sulcate as are the stems, the floral rachis about half as long and 10-20 flowered. Leaves hardly 1 dm. long, rather scattered but longer than the slender internodes. Leaflets 5-8 pairs, distant, about linear, 1.5-4 cm. long, thin, obtuse, rather cuneate at base and on white petiolules, green as are the stems and peduncles. Stipules small, the upper ones green, reflexed subulate from a deltoid base, free, those below hyaline and inclined to connate opposite the petioles. Stems very slender and erect in rather dense tufts, branching above, many, about 2 ft. high. Pubescence almost none. Growing in the Middle Temperate life zone and extending down a little into the Lower, in open gravelly slopes and blooming in summer. Throughout the Columbia Basin as far east as Blackfoot Idaho, throughout the northern part of the Great Basin as far east as Muncy Spring Valley Nevada and westward to the western side of the Sierras at least on both Shasta slopes and northward. Common in the northwest, on prairies and in the sagebrush.

5. *Astragalus Antiselli* Gray Bot. Cal. 1 152 (1876). *A. Hasseanus* Sheldon. Pods in the type about 2 cm. long and 5-7 mm. high, not much flattened laterally and with about oval cross-section finely reticulated all over, oblanceolate to narrowly elliptical, tapering from near tip into the dark filiform stipe which is about 3 times as long as calyx, tip barely acute and apiculate, sutures about equally arched. Flowers about 1 cm. long. Calyx tube as in *A. stenophyllus* but teeth triangular and about half as long as the tube. Pedicels twice as long as the short bracts. Peduncles 1-2 dm. long, about as long as leaves, the rachis a half to a third more and rather densely flowered. Leaves 7-15 cm. long. Leaflets 10-16 pairs, linear-oblong, to elliptical-oblong, rounded, 1-2 cm. long, 4-7 mm. wide, white-ribbed, ashy with minute white hairs closely appressed and fixed by base. Stems slender but rather rigid and from a woody shrubby base, ashy, somewhat sulcate, erect. *A. Hasseanus* Sheldon is a form with longer and more acuminate pods. This may hybridize with *A. trichopodus*. On dry slopes, in the hills of the Coast range from San Luis Obispo California and southward, Antelope Valley, Davidson. Tropical.

Astragalus Antiselli var. *phoxus* Jones Cont. 10 65 (1902). *A. gaviotus* Elmer. Pods with body about 2 cm. long, 7 mm. high and 1 mm. thick, almost completely flattened laterally, on a stipe fully half as long, oblanceolate to linear-elliptical, sutures either equally arched or the ventral the more so, shortly acuminate at both ends, opening first at tip, apiculate. Flowers 15-20, about 1.5 cm. long. Banner arched to erect, 4 mm. longer than wings, with sides reflexed 2 mm. wide in the middle only. Wings linear-oblanceolate, nearly 2 mm. longer than keel and much narrower, little arched. Keel exceeding the calyx tube by 4 mm. nearly straight, tip sharply incurved to a at least 110 degrees, about 3 mm. high, blunt, not dark. Peduncles (and stems) sulcate, 1-3 dm. long, stout. Leaflets 12-15 pairs, nearly contiguous, oblong-elliptical, about 1.5 cm. long, somewhat reduced above. Stipules small and not connate. The plants have the habit of *A. leucopsis*. Santa Inez river southern California and vicinity. Lower Temperate life zone.

This group connects directly with the *Inflatii* through *A. oxyphysus* and *trichopodus*.

6. *Astragalus porrectus* Watson Bot. King 75 (1871). Pods about 1.5 cm. long, exclusive of the stipe, about 4 mm. high and 2 mm. wide, much laterally flattened, shortly acuminate at both ends, at tip into a subulate and straight beak 1-2 mm. long, at base into a very stout tapering straight stipe often twice as long as calyx, arcuate near the base, erect at tip or a little incurved and calyx nearly horizontal. Flowers about 1 cm. long, white, ascending, yellowish when dry. Banner oblong-oval, abruptly erect at calyx tips, with sides reflexed about 2 mm. wide at base, less so above, rather fleshy, the erect part about 1 mm. long. Wings broadly oblanceolate or obliquely elliptical, acutish, about 1 mm. longer than keel and 2 mm. shorter than banner, nearly 2 mm. wide, ascending. Keel about 3 mm. long, the base straight and tip nearly erect and triangular. Calyx hyaline the tube about 3 mm. long and 2 mm. high, abruptly rounded at base and inserted a little below the middle, the triangular teeth about half as long. Pedicels rather stout, about 2 mm. long and equaled by the triangular bracts. Peduncles stout, in the upper axils, about 1 dm. long, the rachis often twice as long or more. Leaves 5-7 cm. long, short-petioled. Leaflets 4-6 pairs, thick, about 1-1.5 cm. long, nearly contiguous, mostly with a broad notch at tip. Stems flexuous, slender, nearly erect, about 2 ft. high, from a strong erect root. Trinity Mts. Nevada and westward nearly to Reno on rocky slopes. Lower Temperate life zone, rarely collected. Watson, Miss Stokes. The plant called *porrectus* by Coville from Pahrump Valley is *A. Preussii*. This plant has the habit of *A. Orcuttianus* but the pod is vetch-like.

7. **Astragalus Californicus** (Gray) Greene Bull. Cal. Acad. 3 157 (1885). *A. collinus* var. *Californicus* Gray Proc. Am. Acad. 12 54 (1876). Pod about triangular at each end in the type and straight but varying to acuminate at both ends and very arcuate, 4-5 mm. wide, the cross section elliptical, rather closely racemose, smooth when old, minutely hairy when young, pendent, finely reticulated throughout, about the same width throughout, opening first at tip. Flowers white, 1-1.5 cm. long, shortly and densely racemose, spreading. Banner 7-10 mm. long, oval, arched to about 45 degrees and abruptly at end of calyx, with sides much reflexed from the base, 3-4 mm. longer than wings. Wings linear, about 1.5 mm. wide arched sometimes to 45 degrees, about 2 mm. longer than keel. Keel with straight base, about 4 mm. long, abruptly arched to erect, the triangular tip rather narrow and 3-4 mm. high, and inclined to truncate, yellow at very tip. Calyx about cylindric, about 5 mm. long and 3 mm. high, very slightly narrower below, hairy, white and hyaline, the upper side a trifle arched and the lower straight, attached at the lower and fleshy corner and nearly truncate there, a trifle oblique at tip, the triangular teeth hardly one-fourth as long and nigrescent. Pedicels in flower 1-3 mm. long and about as long as the triangular to subulate papery bracts, in fruit sometimes 6 mm. long and twice as long as bracts. Peduncles about as stout as stems, sulcate, strict, 1-1.5 dm. long, about twice as long as leaves, the floral rachis nearly as long. Leaves 5-7 cm. long, the upper sessile, a little longer than the internodes. Leaflets 7-10 pairs, 5-12 mm. long mostly folded, acutish to rounded, broadly linear to linear-oblongate, not contiguous, not opposite, cuneate and long-petiolulate at base, hoary with soft and spreading wavy almost woolly hairs fixed by the base. Stems not slender, decumbent below, a little flexuous, about 2 ft. long, sulcate and green, tufted from rather woody root. Stipules triangular-subulate, rigid and reflexed, green above, hyaline below and connate, small. The stipe in type is hardly longer than the calyx but other plants have stipe half as long as the pods and 5 times as long as calyx. In the valleys adjoining Mt. Shasta California on the north. Middle Temperate life zone, in gravelly places. Blooming in April and May.

8. **Astragalus inversus** Jones Cont. 5 276 (1893). Pods nearly horizontal or a little reflexed, 2.5-4 cm. long exclusive of the rather stout and tapering stipe which is about 1 cm. long, reddish when fresh and purplish when dry, 4-6 mm. high, nearly flat when dry but little so when fresh, straight or only a little arcuate. Flowers very loosely racemose, few, ascending, purplish, about 1 cm. long. Banner pinkish when fresh, with red stripes on the outside, about 1 cm. long, elliptical-oblong, a trifle wider below, ascending 45 degrees in a gentle arc from end of calyx tube, 4 mm. wide below, 3 mm. wide at tip, notched barely, with sides reflexed 2 mm wide below, appearing fiddle-shaped by the sulcus being very narrowly U-shaped at base and widening above at the tip where the sides are not at all reflexed, sulcus 1 mm. deep below, becoming a mere line above; white spot barely visible but its place taken by purple veins. Wings obliquely oblongate, ascending 30 degrees, 3 mm. wide, concave to keel and flaring, the left hand one the most so, erose at the acutish tip, pinkish with stripes, nearly 2 mm. longer than keel. Keel lunate, about 2 mm. wide in the middle, acute at both ends and equally arched from base to the erect tip which is yellowish and darker, base of keel nearly round in cross section. Calyx tube round in cross section, campanulate, about 3 mm. long and 2 mm. high, red, nearly equally inserted at the acutish fleshy base, teeth minute, triangular from a broad base. Pedicels stout 1-2 mm. long and about as long as the small, greenish, ovate bracts. Peduncles often a foot long, green and sulcate as are the stems and leaves, very slender and falcate, the few flowers scattered along the upper end. Leaves about 1 dm. long, all petioled with the

green rachis scarcely tapering. Leaflets 2-5 pairs, remote, narrowly linear, acutish to obtuse, conspicuously reduced above, the terminal one phyllodia-like but mostly short-jointed to rachis, and mostly larger or longer than the upper ones, 1-2 cm. long. Stems decumbent to weakly ascending, very slender and lax, 2-3 ft. long, the slender internodes longer than the leaves, several from a fleshy erect root. Whole habit of *A. junceus* and evidently replaces it in the Sierras. Susan with *Pinus ponderosa*, *Quercus*, *Agropyron* and *Lotus* in black and rich soil. Middle Temperate life zone, blooming in June. It has the plant green, and pubescence very sparse and scarcely visible, except on the calyx where it is minute and soft. Stipules green, rigid, subulate, reflexed, about 4 mm. long above, barely connate below and very short. Growing on gravelly lava southern slopes among boulders along ville California and vicinity.

9. *Astragalus campestris* (Nutt.) Gray Proc. Am. Acad. 6 229 (1864). *Homalobus campestris* Nutt. in T. & G. Fl. 1 351 (1838). *Homalobus tenuifolius* Nutt. Not *A. tenuifolius* Desf. This is the common form in high mountains on rocky ridges, alpine and subalpine, with stems mostly flat on the ground from rather woody roots, short leaves and elongated peduncles and rather capitate flowers. Leaflets linear and very acute, the terminal one not elongated much, small, inclined to be ashy-pubescent. From the mountains of New Mexico and probably the San Francisco peaks of Arizona northward to the British line and westward in all the mountains of Utah and probably southern Idaho. Apparently not found in Nevada and the Sierras but to be expected. This form rarely has pods a trifle sulcate dorsally. For the general character of the species see the var *decumbens*. All the varieties freely intergrade according to the shade and moisture in which they grow.

Astragalus campestris var. *decumbens* (Nutt.) Jones. *Homalobus decumbens* Nutt. in T. & G. Fl. 1 352 (1838). *A. decumbens* (Nutt.) Gray *A. convallarius* Greene, *Phaca decumbens* (Nutt.) Piper. *Homalobus Salidæ* Rydberg. Pods about straight, about 2-3 cm. long, linear to oblanceolate, reflexed. Flowers 5-10 Banner obovate to oblong, veined from a darker and ring-like base, about 2 mm. longer than keel, about 3 mm. long, arched abruptly at end of calyx to about 85 degrees, sides scarcely reflexed except at base and less than 1 mm. wide, groove filling the whole banner, 3 mm. wide and 1 mm. deep, deeper below. Wings short, little longer than keel, oblanceolate, arched so as to expose base of keel, 1-1.5 mm. wide, concave to keel, twisted so as to be about horizontal at tip. Keel with erect part about as long as base and sharply arched to 90 degrees and narrowly-triangular-acute. Calyx tube obcompressed at tip, Hedeoma like, campanulate, not deeper cleft above, with rounded sinuses, teeth slender, little shorter than tube. Peduncles very long and erect as to stems, often 2 dm. long, subterminal. Leaves narrow, thin, with 3-7 pairs of flat leaflets linear (often falcate) to narrowly oblong but acute at both ends, 2-25 mm. long, 1-9 mm. wide, rather distant, short-petiolulate and the lateral ones jointed to rachis. Stipules subulate, united near ground. Stems diffuse when growing alone, very slender, rarely 3 dm. long, many, from slender roots which branch below ground and spread out in open tufts, often straggling on the ground in open places but erect mostly in shade. Leaves very variable according to shade. Pubescence attached at the end in the type but with a hump near base representing the other end of a pick-shaped hair, closely appressed and very variable but silvery only in the var. *crispatus*. The type of this variety has erect stems and linear leaves with the terminal one elongated and about as long as the slender petiole and raceme. It has the general habit of *A. junceus*, and is seldom collected. Lima Montana and Rexford, Idaho, Jones. Glenwood Springs, Colorado, Diehl. Type locality in southern Wyoming

along the overland trail by Nuttall. Middle Temperate life zone in brush in dry places. What Gray mistook for this species and intended to be called *A. campestris* is quite different and is what I had in view as *A. decumbens* var. *campestris*. *A. decumbens* (Nutt.) Gray is a lower form with longer peduncles, and with terminal leaflet not elongated and connects with the next. This form blooms from July to September.

Astragalus campestris* var. *hylophilus (Rydberg). *Homalobus hylophilus* Rydberg Fl. Mont. 247 (1900). *H. decurrens* Rydberg. *A. divergens* Blankenship. This is what Gray intended as *A. campestris* and what has been so considered by all botanists since. Plants growing in the shade in moist places mostly at the north. Stems erect normally, with short internodes and long leaves and peduncles with inflorescence rarely surpassing the leaves much. Leaflets thin, mostly green, barely acute, oval to linear, flat. Stems almost filiform from similar and much branched underground branches of the tap root. Common in the mountains at the south from the subalpine down to the edge of the Middle Temperate and throughout the woods of the Middle Temperate at the north, New Mexico to southern Utah, northward and northwestward to the Cascades and the far north. *A. strigosus* C. & F., *A. griseopubens* Sheldon, *Homalobus camporum* Rydberg is an intermediate form with narrower leaves almost silvery-pubescent approaching the type of *A. campestris* var. *decumbens*:

Astragalus campestris* var. *crispatus. Stems densely tufted from woody root, with general habit of *A. campestris*, but inflorescence little longer than leaves. Pods ashy and leaves silvery with loose crisped hairs attached near the middle. Alta Montana in pine woods, Middle Temperate life zone.

Astragalus campestris* var. *serotinus (Gray Pac. R. R. 12 18, 51 t. 5 (1860) as species), *A. decumbens* var. *serotinus* (Gray) Jones. *A. strigosus* C. & F., *griseopubens* Sheldon, *A. Palliseri* Gray. This is a straggling elongated form much tufted and with slender root branches, elongated racemes and peduncles, the whole often 2 ft long, with leaflets from broadly linear to almost filiform, sparingly pubescent, calyx teeth very short and almost deltoid, and keel tip about deltoid and not long triangular as in most forms of the species. This is the common form throughout the Columbia drainage from near the Continental divide to the Cascades in open woods and on prairies. When the calyx teeth are subulate (which is common) and the pod slightly stipitate it corresponds well with *A. Palliseri* Gray.

10. ***Astragalus junceus*** (Nutt.) Gray Proc. Am. Acad. 6 230 (1864) *Homalobus junceus* Nutt. in T. & G. Fl. 1 351 (1838). *A. diversifolius* var. *roborum* Jones. Pods narrowly linear, acuminate at tip, 3-4 mm. wide, when mature cross section almost round from base to tip, generally straight, but sometimes falcate a little either dorsally or ventrally, 3-4.5 cm. long. Inverted on a slender and twisted pedicel. Leaflets all filiform or only rarely some lower ones flat, the upper ones mostly absent and rachis not larger toward tip. Seeds as wide as cavity. Stems mostly few together often solitary. Flowers broad and stubby not 1 cm. long, arched into a half circle. Banner broadly oblong-obovate or wider, arched at calyx tips to 110-125 degrees in sharp arc, the whole upper part is the groove which is a half circle and 5 mm. wide and 1.5 mm. deep and with an accessory groove down the middle, at a point about 2 mm. below tip of banner the groove narrows abruptly to about 1.5 mm. wide. At the base of the groove there is a narrowly triangular white spot with narrow end up and from the sides of this radiate out deep-purple veins darkest below. The erect part of banner is about 5 mm. high, with sides reflexed a trifle only at a point about 2 mm. below keel tip. Wings very obliquely el-

llyptical-ovate and close-pressed to keel to its tip and concave to it, then flare a little and with the upper edge involute a little, wider than keel, arched to 45 degrees and so concealing the keel, 2 mm. wide in the middle, entire, white, rounded. Base of keel falcate upward and the tip arched at least 90 degrees to this in a short arc, and the tip sharp and produced and about 3 mm. high, dirty-purplish and gray-tipped. Calyx short-cylindric, a trifle laterally flattened at base and obcompressed at tip, not deeper cleft above. About 1.5 mm. thick, scarcely fleshy-thickened at base, about 4-5 mm. long. Teeth very short and the sinuses rounded and open. Flowers horizontal, mostly soon reflexed on stout pedicels. Frequent from the borders of Texas through northern Arizona and western Colorado and Wyoming at least to Halleck Nevada and northward to the British line in the upper edge of the pinon and juniper belt and throughout the Middle Temperate life zone in dry places, preferably on gravelly mesas and gentle slopes, mostly in the sagebrush, not in the Columbia Basin. Since this is the common form and the species was described first I use this name instead of *orthocarpus* (*diversifolius* of Gray) which would have to displace the name of Boissier.

Astragalus junceus* var. *orthocarpus (Nutt. in T. & G. Fl. 1 351 (1838) as *Homalobus*). *A. junciformis* Nelson. This is a rare form with the rachis widened to a phyllodium, and with occasionally linear and flat leaflets. Green River Wyoming and vicinity and Helper Utah where all sorts of intergrades occur.

Astragalus junceus* var. *attenuatus. Stems very slender. Leaflets entirely absent or reduced to scales and rachis filiform-attenuate. Pods compressed throughout, narrowly linear, slightly falcate upward, not wider above, about 5 cm. long and 2 mm. high and 1 mm. thick gradually attenuate to a filiform tip. Price Utah on the clay mesas in very poor soil, among the junipers. This is one of those very interesting variations produced by peculiar alkaline deserts of the Navajo Basin, but not growing on alkaline flats, and is doubtless caused not by alkali but starvation, though the plant has become perfectly adapted to its environment as it is thrifty and not a sport, nor depauperate.

11. ***Astragalus Episcopus*** Watson Proc. Am. Acad. 10 346 (1875). *Homalobus* Rydberg. Pods flat even at maturity and with cross-section linear, pod half-elliptical to oblong, 2-3 cm. long, 5-6 mm. high in the middle and hardly 1 mm. thick, tip and base shortly and obliquely triangular, the base sometimes contracted to a thick stipe half as long as calyx, not sulcate, soon reflexed, smooth and shining, with central suture conspicuously the more arched especially near the base. Seeds filling from half to a third of the width of cavity. Calyx campanulate, about 3 mm. long, with very short deltoid teeth. Pedicels slender, about as long as calyx, rarely twisted even in fruit. Flowers white, tinged with purple, above about 8 mm. long, with straight base and tip arched to 45 to 90 degrees. Banner broadly ovate, about 1 mm. longer than wings, with sides reflexed below the middle to 1 mm. wide. Wings oblanceolate, oblique, acutish on the upper corner, about 2 mm. wide and 1-3 mm. longer than keel, little flaring. Keel with straight base, rather sharply arched at tip to 90 degrees, and erect part 3-4 mm. high, rather narrowly-triangular but not conspicuously sharp as in allied species. Stems rigid, round, zig-zag, very much branched forming a mass about as broad as long, the internodes 3-5 cm. long, stems about 1-2 ft high. Petioles almost as thick as stems and equally rigid, tapering but blunt, rarely a trifle widened at tip, 6-8 cm. long, curved, with 1-2 pairs of subalternate scattered leaflets, or the upper ones without leaflets, leaflets when short are oblong, when long are linear, 3-20 mm. long, thick and rigid, blunt. Stipules small hyaline. Proper peduncles as stout as stems and similar, rarely as long as leaves,

with racemose and scattered inflorescence often a foot long, etc. This is clearly a close relative of *A. junceus* though the pods and flowers are decidedly different. It grows in sandy places along the Pahria and in House Rock valley north of Lee's Ferry Arizona and southward along the Little Colorado at least 50 miles. Captain Bishop, for whom it is named also got it probably on the western side of the Kaibab south Kanab.

12. *Astragalus lancearius* Gray Proc. Am. Acad. 13 370 (1878). Mature pods rather shiny but minutely pubescent, light-colored, 2-2.5 cm. long, 5-7 mm. high, flat, ascending when young, horizontal to reflexed when ripe, almost sessile, with apiculate to triangulat ends, oblique but nearly straight, abruptly rounded at base, splitting calyx, finely cross-nerved, with dorsal suture straight or rarely a little concave, but with a convex hump near the tip mostly, tip in line with dorsal suture. Ventral suture very convex especially toward the base. Fruiting pedicels reflexed, 2-4 mm. long. Fruiting racemes long and loose. Flowers in loose racemes, white, with at least the keel and often the wings and banner purple-tipped, narrow, about 1-1.5 cm. long, straight. Immature pods nearly linear, mostly arcuate and not much flattened. Peduncles a foot or two long, sulcate, stout, strict, the rachis nearly as long. Banner ovate, arched abruptly at calyx tips to 45 to 80 degrees, waterlined, with sides reflexed about 3 mm. wide below and not at all at tip, 2-3 mm. longer than keel, rather remote from it and exposing it. Groove in banner 4 mm. wide at tip, and 1 and one half mm. wide and deep below. White spot with 8 broad white lines and narrow purple veins, round. Wings 6 mm. long, about 1 mm. wide, arched, rounded at tip, connivent at tip, concave to keel and 2-3 mm. longer than it, oblong-oblancheolate. oblique Keel a little convex below and sharply rounded to the erect tip above, obtuse, half-triangular-cuneate, reddish-purple, 3 mm. high, straight. Calyx tube cylindrical nearly but flattened a little laterally, nearly straight, 3-4 mm. long, thin, narrowed below and attached on the lower corner, ashy, cleft much deeper above, and oblique at tip, with nearly filiform teeth lax. Floral pedicels often shorter than the bracts. Bracts stiff, triangular, 2-4 mm. long. Proper stems rarely a foot long, flexuous, few, branched below, from a woody root, erect, green. Stipules green, rigid 3-8 mm. long, reflexed, adnate. Upper leaves reduced to the filiform rachis, 3-5 cm. long. Central leaves 7-9 cm. long, with 1-2 pairs of folded or nearly filiform leaflets which are rigid, obtuse, ashy, hardly opposite, 1-2 cm. long, jointed to rachis. Lower leaves shorter and often with 1-2 pairs of linear flat leaflets. The plants have the habit of *A. junceus*, but stems rather more numerous, and root much branched and woody. This abounds on depressions and cracks in the sloping rocks of the San Rafael Swell foot. It blooms early in May and fruits two weeks later. The type locality is the Beaverdam Mts. west of St. George on the edge of Utah. It is more slender than *A. Episcopus* but tufted in the same way

13. *Astragalus Woodruffi* n. sp. Pods broadly linear, about 2 cm. long and 4 mm. high, flat, ashy, cartilaginous, erect and appressed, sessile, arcuate, not splitting the calyx, the triangular beak with a subulate tip and in line with the ventral suture, the base rounded. Sutures prominent and equally arched, the ventral concave. Flowers brilliant-pink-purple, 1-1.5 cm. long, straight, narrow, erect, rather densely spicate. Banner narrowly ovate, ascending 45 degrees in a gentle arc from end of tube, water-lined, purple throughout and without white spot, rounded to a trifle retuse, with sides reflexed 3 mm. wide below and not at all above. Groove a half circle at keel tip and shallowing to a line above and occupying one third the blade. Wings broadly linear, arched 30 degrees, about 2 mm. wide, rounded, oblique at tip, white beyond keel and a little concave, flaring some

above, purple-striped by a single line a little above the midrib. Keel half-cuncate, about 6-8 mm. long and half as wide, purple, rounded at tip, and base straight. Calyx tube campanulate, about 3 mm. long, rounded at base and attached in the middle of the end, fleshy-thickened below, slightly flattened laterally, with lax and subulate teeth as long as tube. Whole plant finely ashy-silky with loose pubescence except the closely appressed-pubescent pods. Pedicels 2-4 mm. long and except in fruit shorter than the bracts which are rigid, green, and 3-5 mm. long. Peduncles stout, very sulcate, 1-2 dm. long, strict, longer than the floral rachis and shorter than the fruiting one, and with loosely racemose pods. Stems coarse and deeply sulcate, often 1 cm. thick, erect, 1-2 feet high, branched below, in very dense tufts 2-5 feet wide and 2-3 feet high, from a thick, fleshy and erect root. Leaves rarely 7 cm. long, small and inconspicuous, with 1-3 pairs of filiform, channeled, leathery leaflets, 1-2 cm. long, not jointed to rachis, distant, like the rachis. Stipules large, leathery, rigid, acute, green coarse, twice as wide and often twice as long as the adjacent leaflets the upper linear and erect, the lower triangular and often 1 cm. wide and as long as the included leaf or nearly. Lower leaves very small. This grows in drifting sand dunes and the like, in the Lower Temperate life zone. It has a strong snake-like odor and dries very slowly the whole plant being leathery. This is the most beautiful species of the genus when the whole mass is ablaze with the pink-purple bloom. On the sandy foot of the San Rafael Swell. Named for the late Robert Woodruff C. E., my companion in trips on the deserts of the Navajo Basin.

13A. *Astragalus Pasqualensis* Jones Cont. 10 87 (1902). Pods about 2 cm. long 2 mm. high and 1 mm. wide, with beak in the middle of the end, sessile, ashy. Flowers purple, rather coriaceous, inclined to be sulcate at both sutures. 7-8 mm. long, wide, ascending, several in a close raceme. Banner round, abruptly reflexed to the calyx at its tip, about 5 mm. long, as long as wings and keel. Wings oblanceolate, about 1 mm. wide, much narrower than keel. Keel about 5 mm. long, 2 mm. high about the middle, half-rhomboidal-obovate, acute, conspicuous. Calyx tube about 1 mm. long, hemispherical, with the subulate teeth twice to three times as long and spreading. Bracts subulate, about 1 mm. long. Pedicels stout, hardly 1 mm. long, reflexed. Peduncles 2-3 cm. long, about half as long as rachis. Leaves 3-4 cm. long, very broad almost sessile. Leaflets apiculate, distant and obtuse, about 2 cm. long, rigid, hoary with very minute and fine hairs fixed by the middle. Stems a foot or two high, decumbent, leafy, with the internodes about half as long as leaves, from a woody base. Santiago de Pasqualo, Durango Mexico, Palmer No. 398, April to May 1896. This is probably not an *Astragalus*. The vrey rigid and immature pods seem to have an inner lining and are wholly 1-celled (described as 2-celled), they seem to be sulcate or inclined to be sulcate at both sutures, and probably are contracted between the seeds and partly separate when mature. But so far as the material goes cannot be referred to any other genus. What is evidently the same species is No. 5831 *Purpus* from Puebla Mexico, May 1912.

14. *Astragalus simplicifolius* (Nutt.) Gray Proc. Am. Acad. 6 231 (1864) *Phaca simplicifolia* Nutt. in T. & G. Fl. 1 350 (1838). *Homalobus uniflorus* Rydberg. Pods linear and short-acuminate to triangular-ovate, straight or with ventral suture concave, not over 1 cm. long, about 2 mm. high, completely flat when young, elliptical in cross section when ripe, with acerose tip, sometimes barely exceeding the calyx, mostly 1-seeded. Flowers 6-8 mm. long, with light claws, solitary in the type, on peduncles not longer than the very short leaves. Banner about 5 mm. long, oval, arched abruptly at calyx tips to about 60

degrees, hooded and emarginate, as long as, to 1 mm. longer than wings, groove deeper below, sides reflexed most in middle to 1 mm. wide, white spot very small and purple-veined. Wings arched 30 degrees, concealing keel, narrowly oblong, rounded, 2 mm. wide, as wide as and 2 mm. longer than keel, concave to it, one bent over keel and the other bent out, inclined to be white-tipped. Keel rounded till the tip is erect or more incurved, obtuse to acute, dark-purple. Calyx narrowed but not gibbous below, not flattened, cleft deeper, above, appressed hairy, lower side straight and upper arched, tube 2-3 mm. long, teeth subulate and arched, about as long as tube. Pedicels about 1 mm. long in flower and 2 mm. long in fruit, much shorter than the bracts which are lanceolate, acuminate and nearly as long as calyx tube, pubescent. Leaf rachis rather rigid, enlarged above to a single unjointed leaflet which is in the type oblanceolate to spatulate or linear, flat or involute and barely 2 cm. long. Stems in dense cushions each crown about as broad as long. Branches of root 2-3 mm. thick, cushions 1-2 feet in diameter. The type grows on the arid clay plains of the Green River Basin Wyo. and adjacent Utah to Cave Hills S. T. & G. Blooms May to July. It passes by imperceptible gradation into

Astragalus simplicifolius var. *cæspitosus* (Nutt.) Jones Cont. 7 647 (1895) *A. simplicifolius* var. *spatulatus* (Sheldon) Jones Cont. 10 65 (1902) *A. spatulatus* Sheldon Minn. Bot. Stud. 9 22 (1894) *Homalobus cæspitosus* Nutt. in T. & G. Fl. 1 352 (1838) *Tragacantha cæspitosa* (Nutt.) Kuntze, *Homalobus canescens* Nutt, and *brachycarpus* Nutt. *A. lingulatus* Sheldon. *A. exilifolius* Nelson. Pods linear, nearly 1 cm. long, straight or arched, erect or ascending, short-racemose. Flowers several, capitate. Pedicels in fruit at least as long as the bracts, Peduncles conspicuous, longer than the leaves. Leaves either a long ligulate or filiform petiole without leaflets (3-5 cm. long) or with 1-2 pairs of filiform to oblanceolate leaflets mostly jointed to the rachis. From the Plains of central Colorado through Wyoming to the Wasatch, and from the Cedar Mt. near Green River Utah and Duchesne Valley Utah northward to Assiniboia and the Yellowstone Park. *A. lingulatus* is the form with phyllodia-like petiole. *A. exilifolius* is a form with pods of *simplicifolius* and leaves nearly of *lingulatus*.

15. *Astragalus detritalis* Jones Cont. 13 9 (1910). Pods narrowly-linear, falcate, about 2-3 cm. long, and 2 mm. high, minutely pubescent and mottled, flat when young at least, ascending, capitate, nearly sessile, with short-triangular and declined tip. Flowers about 1.5 cm. long, several, capitate. Calyx short-cylindric, about 5 mm. long and 3 mm. wide, with conical base, equally inserted, oblique at tip and much deeper cleft above, the arcuate and subulate teeth unequal and as long as tube. Banner oblong-oval, notched, 8 mm. long, erect, arched in gentle arc from base to tip, with sides reflexed 1 mm. wide in middle, white spot of several bands 2 mm. below tip. Wings with blade narrowly oblong, about 3 mm. wide, rounded and obtuse, flat to keel about 2 mm. shorter than banner and 3 mm. longer than the straight, lunate or boat-shaped keel which has a rounded and erect tip. Bracts about 8 mm. long with green tips. Leaves 5-8 cm. long, with slender petioles and about 2 pairs of oblanceolate leaflets all jointed to rachis as well as the terminal one which is not conspicuously larger than the rest, some of the less developed leaves are much shorter and sometimes with obovate leaflets. Stipules lanceolate. Stems very short but not reduced to crowns, the internodes nearly as long as the stipules. Growing in small mats rarely a foot in diameter on clay knolls in the canon south of Theodore Utah on the upper edge of the Juniper belt. This may be an extreme form of *A. simplicifolius* but though the material is ample there are no intergrades known.

16. **Astragalus montanus** (Nutt. in T. & G. Fl. 1 353 (1838) as Kentrophyta) *Tragacantha montana* (Nutt.) Kuntze, A. Kentrophyta Gray. *Homalobus montanus* (Nutt.) Britton, *Kentrophyta viridis* Nutt. This is a very variable species. The type has very rigid stems and leaves, the latter nearly sessile and with very spinose and rigid channeled rigid leaflets 5-10 mm. long which are linear-subulate, with conspicuous, hyaline and spiny stipules. Pubescence attached near the middle. Flowers 5-10 mm. long, white with purple keel tip. Banner arched to about 90 degrees or less abruptly and with hump below the bend, hooded, with very concave sides and little reflexed, the groove very narrow, the blade contracted about 2 mm. below the tip so that the general outline is oblong, the tip abruptly reflexed or not at all, deeply notched, a little wider at tip than below, finely striate-veined with purple, white spot evident, broad veined; wings connivent, oblong, ovate, to lunate obtuse to barely acute, about 3 mm. longer than keel or bearing the same relation when flowers are smaller, ascending to nearly 90 degrees. Keel purple-tipped and very sharp and much incurved. The right wing folded over the end of the keel. Calyx short-campanulate and obconical and Hedeoma-like, with broad sinuses and subulate curved teeth about as long as tube which is about 2 mm. long, sometimes a little flattened above, obliquely attached. Pods in the type obliquely ovate, with short-acuminate tip, hoary, laterally flattened, not sulcate, about 4 mm. long. It abounds in mats on the bad lands of Wyoming, to S. Dakota mostly on clayey knolls, extending over into Dakotah and Colorado and northward to Alberta, and southward to northern Arizona and New Mexico. Upper edge of the Lower Temperate and lower part of Middle Temperate life zone.

Astragalus montanus var. Coloradoensis (Jones as Kentrophyta var. Cont 10 63 (1902). This is a form with stipules all free and small but acerose, white stems, and similar pods 10 mm. long. In the hot region of northern Arizona at Lee's Ferry on the edge of the Tropical life zone in dry plains.

Astragalus montanus var. unguatus. (Jones Cont. 7 650 (1895) as Kentrophyta var. This is a very condensed form with leaves hardly 1 cm. long and leaflets about 7 mm. long. Stipules hyaline small and not acerose. Flowers about 5 mm. long. Pods claw-like obliquely ovate, with arched tip and nearly round in cross-section, rarely a trifle sulcate, hoary, 3-4 mm. long, mostly single in the axils. Spruce-mont Nevada on barren gravelly knolls, Lower Temperate life zone. Kentrophyta *Wolfii* Rydberg is about this form.

Astragalus montanus. var impensus (Sheldon Minn. Bot. Stud. 9 118 (1894) as A. *viridis* var. A. Kentrophyta var. *elatus* Watson. Kentrophyta *impensa* (Sheldon) Rydberg. This is an erect form or a matted form where some of the central stems are erect and often 2 feet high, with leaves of the type but mostly shorter, and the small flowers and pods of the var. *unguatus*, but generally 2 or 3 feet at each node and pods sometimes with an elongated falcate and acerose tip and often nearly smooth. This has the widest range of all the forms, from Fort Wingate through northern Arizona, the Navajo Basin, westward to Pioche and the Sierras, throughout Utah and northwestward to Walla Walla in the Columbia Basin, at least in eastern Nevada. In the Lower Temperate life zone on dry gravelly mesas, mostly among the junipers.

Astragalus montanus var. rotundus. (Jones Cont. 7 650 (1895) as *tegetarius* var. *rotundus*.) This is a prostrate straggling form with long stems and long internodes mostly, with the small pods and flowers of the var. *unguatus* but pods conical, little flattened normally straight and with sutures arched and convex and with a triangular tip, leaflets about 5 mm. long and barely needle-tipped. linear. Flowers light-purple. Among the pine forests at the head of the Sevier Utah, Middle Temperate life zone. A similar form on the

Summit of Mt. Warren in the Sierras, Congdon. This is intermediate between the other montanus forms and tegetarius but still has the hairs not fixed by the base.

Astragalus montanus var. tegetarius (Watson Bot. King 76 (1871) as species). *A. Kentrophyta* var. *tegetarius* Jones. *A. aculeatus* Nelson *A. tegetarius* var. *implexus* Canby. This is the high alpine form with filiform matted prostrate stems, very short leaves and leaflets rather green, mostly flat and linear-oblong and abruptly aculeate. Stipules connate, hyaline, often needle-tipped, flowers minute to 7 mm. long, normally purple but often white, either a few on a manifest short peduncle or single and mostly sessile. Pods from 3 to 8 mm. long, from oval, or half-oval, to ovate, little oblique, apiculate, much or little flattened laterally, smoothish when mature. Pubescence attached by the base. The only constant character is the pubescence attachment, in all other respects it shades into *A. montanus*, while the broader leaved forms of it have the hairs attached close to the end. Common in the high mountains from Colorado to the Sierras and northward to Montana and the mountains of eastern Oregon. alpine and subalpine.

17. **Astragalus humistratus** Gray Pl. Wright 2 43 (1853). Tium Rydberg. *A. albulus* Wooton & Stanley. Leaves except the lowest, almost sessile, short with rather many pairs of leaflets, mostly close-set. Stipules united almost to very tip and large. The species is very variable. The type character is given below. Stems intricately branched only close to the stout tap root, then straggling over the ground vine-like for 1-2 feet. Leaflets contigous less pubescent above, linear-oblong, fully 1 cm. long, acute, hoary. Bracts large, about as long as calyx, subulate-lanceolate. Peduncles longer than the leaves and with short-racemose pods which are narrowly oblong, somewhat falcate, 1.5-2 cm. long, almost smooth to pubescent, several seeded rigid, sulcate dorsally and with raised ventral suture. Flowers rather many, thick, inclined to be subcapitate, lead-purple to dirty-white. Banner water-lined, obcordate, with sides reflexed below, the groove deeply fan-shaped below and shallowing above making the banner seem hooded from behind. Wings nearly acute, sinuate to notched on the lower side, arched to about 20 degrees, oblanceolate to obovate, 3 mm. wide, wider than the keel, the right hand one hooked over the end of keel and 1 mm. longer than keel, about 4 mm. long, light-colored. Keel dark-tipped, the erect part about as long as base and produced and rather acute, 3 mm. long. Calyx obcompressed toward tip, campanulate, about 3 mm. long, with rounded sinuses. often 2-bracted at base, from hoary when young to smooth when old, often wrinkled; teeth subulate and about as long as tube. Leaves less pubescent above, often silvery. From the borders of Texas to the Sierra Madres of Chihuahua and the Colorado river and northward to Las Vegas, New Mexico, to the Navajo Basin, Panguitch and Cedar City Utah and Pioche Nevada on gravelly mesas among pines and junipers, Lower and Middle Temperate life zones. The species seems to vary only in the San Francisco Mt. region, where it is common. *A. Arizonicus* has much the same appearance as this.

Astragalus humistratus var. Sonoræ (Gray) Jones Cont. 10 58 (1902). *A. Sonoræ* Gray Pl. Wr. 2 44 (1853). Petioles evident. Leaflets linear, rather distant, over 1 cm. long, acute, hoary. Peduncles not longer than leaves. Pods lunate hardly 1 cm. long, much incurved, about 5 mm. high from suture to suture, not sulcate, much obcompressed below. Plants less elongated. Stems long-persistent. This is a common form in Arizona to Cedar City Utah.

Astragalus humistratus var. Hosackiae (Greene) Jones Cont. 10 58 (1902) *A. Hosackiae* Green Bull. Cal. Acad. 3 157 (1885). Whole plant sparingly pubescent. Leaflets smooth above, elliptical, hardly 1

cm. long, flat, contiguous and leaves sessile and short. Pods ovate, acute, about 6 mm. long, oblique and inflated but not conspicuously arcuate, cross section, inclined to be reniform and dorsal suture raised as in the species. Racemes short. This is a common form growing in the shade on the Mogollon plateau of the San Francisco peaks.

Astragalus humistratus var. tenerrimus Jones Cont. 7 649 (1895). This is the most slender form of the species with filiform stems growing in loose mats even 3 ft. in diameter, elongated filiform peduncles 2-3 times the leaves which are 2-3 cm. long, the stem ones sessile, the other with filiform petiole evident. Leaflets flat, rarely contiguous, 3-5 mm. long, oval to elliptical, about 5 pairs, rounded and obtuse, nearly smooth. Flowers about 8 mm. long, few. Pods broadly oblong and arcuate to 45 degrees, laterally flattened, about 1 cm. long, and 5 mm. high, not sulcate, smooth. In the parks of the Kaibab or Buckskin Mts. Arizona, overlooking the Grand Canon under the shade of the spruces and pines. Middle Temperate life zone. In gravel.

18. **Astragalus sesquiflorus** Watson Proc. Am. Acad. 10 346 (1875). Phaca Rydberg. Leaves all on filiform rigid petioles which are mostly as long as leaf-rachis, 2-3 cm. long. Leaflets 3-4 pairs, barely contiguous, linear-elliptical, very acute at both ends, 3-7 mm. long. Whole plant hoary except the pods. Stems in dense, soft and not compact, 1-3 dm. wide tufts with innumerable branches only a few inches long rising a few inches above the ground, the internodes only on the longer stems rarely much surpassing the recurved and long-acuminate stipules. Peduncles filiform and rigid and with the rachis a little surpassing the leaves, with flowers very few and racemose toward the ends, on pedicels about 2 mm. long which are much shorter than the filiform, elongated, recurved and long-hairy bracts. Calyx Hedeoma-like, that is campanulate or conic, acute at base and equally inserted but not at all compressed nor oblique, the tube about 2 mm. long, and the subulate and arched teeth about 3 mm. long. Flowers bluish-purple, 5-8 mm. long. Banner bent sharply at the end of keel to erect, sides scarcely at all reflexed, about 4 mm. wide, with oval outline, but as you look at it broadly ovate. Groove in banner forming a half circle, about 2 mm. wide and extending to tip of banner. No white spot. Wings 1 mm wide, bent up at calyx tube to 45 degrees and exposing keel base, oblanceolate and obtuse, very oblique, 3 mm. long, concave to keel and close-pressed to it and not quite as long, purple. Keel with tip bent abruptly at calyx tip to 90 degrees, acuminate to a sharp tip, about 3 mm. high and tip dark-purple. Pods often mottled, shaped about like a meat-chopper that is, broadly oblanceolate-falcate, with the deltoid tip erect and ending in a long subulate cusp, about 1 cm. long, flat toward tip, triangular-cordate in the middle by being sulcate, gradually flattening down toward base till completely obcompressed and inclined to be substipitate, seemingly but not at all inflated. This has a superficial resemblance only to *A. pauciflorus*, being manifestly a close ally to *A. humistratus* and connecting with the *Sericoleuci*. On Sandy edges from the Pahria through Kanab and the Virgin bluffs in the Grand Canon region. Lower Temperate life zone. Blooms in April.

19. **Astragalus humillimus** Gray Brandegees Rep. San Juan 235 (1876). Phaca humillima (Gray) Rydberg. Densely caespitose and practically aculeoscent in small mats from very woody and short branches of the crown. Leaves about 1 cm. long, the filiform petiole about half the whole. Leaflets 3-5 pairs, folded, thick, silvery, about 2 mm. long. Stipules lightly hairy above, closely imbricated, broadly ovate to deltoid. Peduncles a little longer than the leaves, 1.5-2 cm. long, with 1-3 flowers racemose at the ends. Flowers hardly 5 mm. long, light-purple, horizontal, on a relatively slender pedicel. Bracts

broadly ovate and acutish, a little longer than the pedicels but not equaling the calyx. Calyx obconic, rather oblique at tip and base, a little over 2 mm. long, with the triangular black teeth about a third the whole. Banner purple-speckled, about 2-3 mm. long, abruptly arched at calyx tips to nearly erect, about oval but with sides reflexed from base to tip and seeming oblong. Wings a trifle shorter than banner and arched 45 degrees, broadly oblanceolate, obtuse, not exposing keel, white or tinged with purple and a little speckled, keel about 2 mm shorter than banner (blade) and gently arched to near the tip and then sharply arched in all to about 200 degrees, then the very broadly deltoid tip erect, purple. Pods hoary, ovate and with cross section rather rounded, about 4 mm. long or less, about 1-seeded. Apparently not sulcate nor conspicuously oblique. This has the habit of *A. montanus* and has doubtless been mistaken for it. Blooms April to May. Gathered by Brandegee on the Mesa Verde Colorado. Apparently common at the Grand Canon of the Colorado at the end of the railroad on sandy ledges. The floral characters are taken from the Grand Canon material. This can at once be separated from *montanus* by the leaflets jointed to the rachis

20. ***Astragalus Gilensis*** Greene Tor. Bull. 8 97 (1881). Leaflets about 8 pairs, shortly acute, 5-7 mm. long, with the appearance much that of *A. humistratus* and with hairs not fixed at the ends. Leaves inclined, to spread out on the ground, 5-8 cm. long, rarely more. Peduncles many, scapose, inclined to be decumbent, 10-12 cm. long. Flowers capitate, about 16, purple, about 7 mm. long. Calyx tube about 3 mm. long campanulate, narrowed below, the subulate teeth nearly as long. Bracts acuminate-lanceolate, ascending, hyaline, about 3 mm. long. Banner nearly round, 2-3 mm. long, abruptly arched to erect at calyx tips, with sides much reflexed and rather deeply notched. Wings broadly linear, rounded, arched to 45 degrees and exposing keel base, about 2 mm. shorter than banner and as much longer than keel. Keel almost exactly that of *A. humillimus* but tip a trifle more acute, about 2 mm long. 1 mm. shorter than wings. 2 mm longer than calyx. Pods about 5 mm long, and a half longer than the calyx, half-oval, the dorsal suture straight and the ventral much arched and very thick, not inflated, laterally flattened and cross-section elliptical, sharply and very abruptly apiculate, rigid and hoary with close hairs, both sutures thick and prominent. This has many short branches from the crown and conspicuous stipules overlapping so as to form a narrow cone like mass 1-3 cm. wide, the edges somewhat ciliate but otherwise hyaline and smooth. This has the general appearance and habit of *A. calycosus*, but the flowers and pods are of the *Sericoleuci*. This grows in dry places along the canon of the Gila in New Mexico and Arizona. Lower Temperate life zone. Also gathered by Parry No. 264 Mex. Bound. Survey at Santa Cruz Pass. Also in the Mogollons Socorro Co New Mex Metcalfe.

21. ***Astragalus sericoleucus*** Gray Am. Journ. Sci. Ser. 2 33 410 (1862). *Phaca sericea* and *trifoliata* Nutt. *Orophaca serieca* (Nutt.) Britton. *Tragacantha sericea* (Nutt) Kuntze. Pods hoary, about 6 mm. long, oblong-ovate, flattened a little laterally but not arched, half included in calyx, a trifle inflated. Flowers normally purple, nearly sessile, rarely 1 cm. long, few at the ends of a short peduncle which is rarely as long as the leaves or even shorter than the stipules. Banner oval to obovate, notched, 4-8 mm. long, abruptly arched at end of calyx to erect or more, with evident white-spot and purple-veined. Wings lanceolate, often oblique, about as wide as keel at base and 2-3 mm. longer and about as much shorter than banner. Keel not surpassing calyx teeth, with base about straight and erect part as long and arched sharply to at least 90 degrees, obtuse and purple-

tipped. Calyx conic, with tube about 3 mm. long and as long as the triangular and curved teeth. Bracts often as long as calyx. Primary leaves sometimes with 5 leaflets, the rest with three, early petioles very short and later ones elongated. Pubescence attached near the middle, fine and wavy. In the type the calyx is not deciduous. It closely resembles *A. Alberti* Bunge. Frequent on the plains of northern Colorado and adjacent Nebraska and Wyoming. Middle Temperate life zone, in dry places. Blooming in May.

Astragalus sericoleucus* var. *aretioides Jones Cont. 8 13 (1898). *Orophaca* Rydberg. This is a very condensed form with flowers barely exerted from the stipules and with stems reduced to crowns, the leaves very short and with almost no petiole. Leaflets usually acute. On gravelly hills of the Laramie Plains, Wyoming.

Astragalus sericoleucus* var. *tridactylicus (Gray) Jones Cont. 10 69 (1902). *A. tridactylicus* Gray Proc. Am. Acad. 6 527 (1865.) *Orophaca* Rydberg. *Tragacantha* Kuntze. *Phaca digitata* Nutt. An unpublished name. Pods globose-ovate, nearly smooth to puberulent, 3-4 seeded. Flowers mostly included in the stipules, from 1 cm. long to half as long and very variable. Calyx soon falling from the pod. Leaves usually long-petioled. Leaflets rather narrow and often 1.5 cm. long. Stems reduced to crowns. With the type but less common. The extreme form seem very distinct, but it intergrades.

22. ***Astragalus tegetarioides*** Jones Cont. 10 66 (1902). Pods about twice the calyx, about 3 mm high and 1-2 mm. wide, abruptly apiculate at both ends, splitting the calyx, chartaceous, coarsely reticulated, translucent, laterally flattened but bulged at the single seed, ashy, rather ascending, sutures obscure and nerve-like, sides rather concave, cross section ovate, or when bisulcate dorsally appearing 4-angled, both sutures convex but the ventral the more so. Flowers about 5 mm long, horizontal. About half a dozen in a head which becomes a short raceme in fruit, 5 mm. long. Banner purple-striped, about 3 mm long, oval, abruptly erect at end of teeth, with sides much reflexed. Wings broadly obovate, very oblique, wider than keel and 1 mm. longer, 1 mm. shorter than banner. Keel barely surpassing the calyx, rounded from base to a half circle, obtuse, about 1 mm. high. Calyx turbinate-campanulate, the tube about 1 mm. long, narrowed and unequally inserted at base on a filiform pedicel which is at least as long as calyx tube, not oblique above. Teeth subulate, lax, nearly 2 mm. long. Bracts lanceolate, shorter than the pedicels. Peduncles filiform, about 2 cm. long. Leaves 2.5-4 cm long, with the filiform petiole over half the whole. Leaflets thick, folded, nearly contiguous, about 4 pairs, 4-5 mm. long, obovate to oval-obcordate, with cuneate and long-petiolulate base, truncate, to notched. Stipules nearly deltoid, with subulate tips, green at first, 3-5 mm. long. Stems much branched forming dense mats, about 1 mm. thick, flexuous, with internodes about 1 cm. long. Whole plant silvery with wavy hairs. On the southern Blue Mts. Oregon in the Buck Range, in sandy soil, No. 2619 Cusick, blooming in June. This has the habit of *tegetarius* and *lentiformis*. But for the 1 celled pod it would go with *lentiformis*.

23. ***Astragalus quinqueflorus*** Watson Proc. Am. Acad. 21 450 (1886). Pods about 4 mm, high and 2-3 mm wide, ashy, half-oval, very obtuse and apiculate, coarsely 5-7 ribbed, with thick sutures, rarely a little sulcate dorsally in the middle, laterally flattened, with cross section ovate or a little cordate, pendent, splitting the calyx, several seeded. Flowers white, about 3 mm. long, rarely 5 in a loose raceme. Banner round, abruptly arched to erect at end of tube, about 2 mm. long, sides a little reflexed. Wings oblanceolate, arched, about 1 mm longer than keel and as much shorter than banner. Keel about 1 mm long the base a little arched and end abruptly rounded to about 110 degrees and then

the tip erect and acute, about 1 mm. high, purple-tipped. Calyx tube about 1 mm. long, campanulate, acute at base and equally inserted, cleft deeper above and with unequal teeth about as long as tube. Pedicels slender, about 3 mm. long, much longer than the minute bracts. Peduncles filiform, subterminal, often 1 dm. long, weak, with fruiting racemes 1-3 cm. long. Leaves about 5 cm. long, with the petiole fully half the whole. Leaflets about 4 pairs, thickish, broadly linear, obtuse, hardly 5 mm. long, folded, distant. Stipules not connate, triangular to subulate, 2-3 mm. long. Stems a few inches long, many from the crown, with slender internodes, prostrate. Hills and plains of Chihuahua Mexico to Zacatecas. Tropical. This has the habit of *A. Brandegei*.

TRIPHYLLI 2.

Densely caespitose and acaulescent plants with large crowns and digitate silvery leaves. Flowers elongated and narrow 2-3 cm. long, white. Peduncles none, with flowers sessile among the stipules which are large, hyaline and smooth above and long-hairy below. Pods about ovate, hoary, very small and inclosed in calyx. Much nearer related to the Ocreati than the Sericoleuci.

Flowers smooth.	24	triphyllus
Flowers hairy.	25	hyalinus

24. *Astragalus triphyllus* Pursh Fl. 740 (1814). *Phaca caespitosa* and *argophylla* Nutt. *A. gilviflorus* Sheldon. *Orophaca caespitosa* (Nutt) Britton. Leaflets 3-5, oblanceolate, 1-2 cm. long, acutish, often folded, jointed to the variable petiole, densely pubescent with warty straight, slender hairs fixed near the base. Flowers with banner oblanceolate to obovate and with a long and narrow claw, a little arched at tip in a gentle arc, sides much reflexed, about 9 mm. longer than keel. Wings linear to narrowly oblanceolate rounded and obtuse, straight, about 3 mm. wide, as wide as keel and 2-7 mm. longer. Keel blade broadly linear, straight, about 7 mm. long, purple-tipped, but little wider at tip where the lower side is arched in semicircle and with the upper corner very obtuse and not produced, general outline nearly linear-cuneate. Calyx tube cylindrical, often a little inflated, 1-1.5 cm. long, straight, laterally flattened, with acute and oblique base, not 5 mm. wide. appressed-shaggy with white hairs, the teeth triangular and about 3 mm. long. Pods 5-7 mm. long, acute, cross section nearly round, the ventral suture a trifle arched, little if at all sulcate. Ventral suture raised and decidedly thickened. On the Plains from Nebraska and northern Colorado to the base of the Rockies and northward to the Saskatchewan, apparently not on the Pacific slope. Blooms early in May.

25. *Astragalus hyalinus* Jones Cont. 7 648 (1895). Stems loosely matted, usually erect 2.5-6 cm. high at the ends of the much branched tap root. Stipules very conspicuous, large and much imbricated, at least 2 cm. long, smooth except at base. Leaflets narrowly elliptical to oblanceolate, about 1 cm. long and 4 mm. wide, 3, densely silvery-silky with hairs attached near the middle. Petiole variable. Flowers and pods similar to the above but flowers hairy all over. On the Plains with *A. triphyllus* and may be an abnormal form.

DEBILES 3.

Pods nearly sessile or shortly stipitate, papery (chartaceous in *A. leptaleus*), inflated, completely 1-celled, and with dorsal suture not at all intruded, nigrescent, becoming glabrous with age, about straight but oblique, nearly half-oval to half-ovate or narrowly oblong, but little flattened laterally if at all (decidedly flattened in *A. Bourgovii*), cross-section nearly round, not sulcate or only flattened dorsally (sometimes sulcate in *leptaleus* and *Bourgovii*). Ventral suture about straight and tip not declined (except possibly in *A. polaris*), dorsal suture the more arched. Flower 7-12 mm. long, few or in heads. Calyx tube nigrescent, cleft deeper above, hyaline, campanulate, 2-3 mm. long, narrowed below, the teeth subulate and nearly as long as the tube. Petals rather broad and short-clawed. Keel purple-tipped. Peduncles long and filiform. Bract green and lanceolate, a little longer than the pedicels, small and short. Leaflets thin and flat. Stipules large, connate at least below, green. Stems slender, perennial, flexuous, weak, with slender internodes and weak and narrow leaves, spreading over the ground, from rather slender roots and much divided crowns from fleshy or woody roots. This section would seem to belong to the *Inflati* but all its relatives are here. *A. vaginatus* Pall. referred to in Hooker's *Fl. Bor. Am.* 1 149 in which the description of Pallas is quoted would naturally come here, but that species is *A. versicolor*, while the plant of Richardson (on which Hooker bases *A. vaginatus*) and which Sheldon calls *A. Richardsoni* is *A. Bourgovii* probably. *A. versicolor* does not grow in America.

KEY

- A.** Pods large, oval-oblong, 3-5 cm. long, greatly inflated, not reflexed, single or few at the ends of filiform peduncles. Roots not woody.
Arctic plants. 26 *polaris*.
- 2A.** Pods small, not over 1.5 cm. long, somewhat inflated, the cross section inclined to be ovate, on a minute stipe, or short, few at the ends of the filiform peduncles.
- 2AB.** Pods apparently sessile or on a scarcely noticeable stipe, oblique, broad. Flowers capitate when in bloom.
Leaves petioled, rather few. Leaflets 3-5 pairs. Wet meadows 27 *debilis*.
Leaves sessile., very many. Leaflets 6-8 pairs. Arctic. 28 *Yukonis*.
- 2A2B.** Pods distinctly stipitate, little oblique, narrow, mostly sulcate dorsally. Leaves all petioled.
Stipe 2 mm. long. Calyx 3-4 mm. long. Pods sharp at both ends.
Peduncles shorter than leaves. Pedicels longer than bracts. 29 *Bourgovii*.
Stipe about 1 mm. long. Peduncles longer than leaves. Pedicels not longer than bracts. Pods acutish only. 30 *leptaleus*.

26. **Astragalus polaris** Benth. in Hook. f. Arct. Pl. 323 (1861). This is also Tr. Linn. Soc. 330. Pods about 2 cm. wide and high, speckled, obtuse at both ends, seemingly much obcompressed, with dorsal suture a little arched and the ventral about straight when mature but convex when young and with tip declined, ascending, black-hairy, sessile or with a minute and jointed stipe splitting the calyx. Calyx rather long-campanulate, 4 mm. long, the teeth about half as long. Flowers 1-3, the blades of petals 3-4 times as long as calyx, the keel shorter than the rest. Peduncles about 1 dm. long in fruit, axillary. Leaves about 1 cm. long, with a petiole about 1 cm. long. Leaflets 5-7 pairs, ovate to oblong or elliptical, about 2 cm. long and 7 mm. wide, retuse to deeply notched short-petiolulate, distant. Stems delicate and very slender, about a foot long, diffuse. Stipules hyaline, about 7 mm. long. Internodes about 2-3 cm. long. Plants smooth to sparingly pubescent. This imperfectly known species from Cape Vancouver grows in the tundra. Arctic.

27. **Astragalus debilis**. (Nutt.) Gray Proc. Phil. Acad. 60 (1863). *Phaca debilis* Nutt in T. & G. Fl. 1 345 (1838). *A. Bodini* Sheldon. *Homalobus* Rydberg. Pods half-oval, about 5-8 mm. long the ventral suture about straight or a little convex toward the end, about 3-4 mm. high, rather laterally flattened, the cross section being broadly ovate or rarely a little cordate by being a trifle sulcate dorsally, minutely stipitate, apiculate at both ends, widely spreading or reflexed. Flowers in the type in dense heads on peduncles longer than the leaves, shortly-spicate in fruit, light-purple to purple-tipped, many, spreading, about 1 cm. long, rather narrow. Banner oval to oblong-oval, about 5-7 mm. long, ascending abruptly to 45 degrees at calyx tips, with sides reflexed below and about one half mm. wide, not at the notched tip; groove reduced to a mere line above but forming a half circle and about 1 mm. wide below keel tip; white spot comes within 1 mm. of tip, is obovate to fan-shaped and lacerate above with fine purple lines, purple veins run through the spot and unite in twos below but do not form a ring, spot is about 2 mm. wide and 3 mm. long, the whole banner is purple-veined. Wings about 3 mm. long, sometimes 2 mm. wide, obliquely oblong, with narrowed but obtuse tip, left one spreading, concave to keel and nearly horizontal with concave side down toward the tip and right hand one incurved over keel, nearly 2 mm. longer than keel and as much shorter than banner, purple-veined. Keel much inflated near the calyx tips but flat beyond and a half longer, incurved about 100 degrees and very obtuse, dark-purple. Calyx tube about 3 mm. long, almost cylindrical, laterally compressed below and obcompressed near tip, the lower side straight, the upper arched, neither oblique nor unequally inserted. Teeth equal, subulate and 2 mm. long. Pedicels short and stout, black, 1 mm. long in flower, often twice the calyx and inclined to be twisted in fruit. Bracts, about 3 mm. long. Peduncles 2-12 cm. long. Upper leaves slender, narrow and sessile, rather appressed, rarely 1 dm. long, green, a little fleshy when fresh but drying very thin. Leaflets 6-8 pairs, oval to lanceolate mostly acute, 4-15 mm. long, about 6-8 mm. wide, ascending, rarely contiguous. Stipules triangular 4-10 mm. long, mostly reflexed, green. Stems weak, slender, delicate, 1-3 ft. long, many, prostrate when not supported by grass forming masses 2-4 feet wide from woody crown. Pubescence of whole plant sparsely ashy to almost none. Grows in moist meadows where the soil is a little alkaline. Middle Temperate life zone. Blooms in late summer. This is a plant of wide distribution but rarely seen. North Park Colorado Osterhout, Cummins, and Centennial Valley Wyo. Nelson; Loa, Utah Ward and Jones, British Columbia Macoun, North Platte Neb. Rydberg distributed as *A. giganteus*; Stevenson and Laramie Wyo. by Cleburn in 1875. A form from Salubria, Idaho by myself though only

in flower and with all the leaflets short, oval and very obtuse, and peduncles only half as long as the leaves probably belongs here. *A. Bodini* is the ordinarily well developed form.

28. *Astragalus Yukonis* n. sp. Pods immature, oblong-lanceolate, acuminate and somewhat arcuate upward, hardly 5 mm. long, ascending. Eastwood pods are about 7 mm. long by 3 mm. wide, broadly oblong, round to a little oblate in cross-section, 2-3 seeded, thin, short-hairy, erect, a trifle cordate at base, with strong raised ventral suture externally, shortly and very obliquely acute. Flowers purple, about 8 mm. long, about 5 at the ends of almost capillary peduncles longer than the leaves. Banner obovate, about 5 mm. long, arched abruptly at end of calyx to nearly erect, with sides reflexed about 1 mm. wide to tip; white spot triangular and purple veined, with the center produced as a white strip to tip of blade, 2-3 mm. longer than wings. Wings oblanceolate, oblique, a little arched, rounded, about 1 mm. longer than keel. Keel about straight along the base, about 4 mm. long, the tip abruptly erect, obtuse and 3 mm. high. Calyx tube about 2 mm. long, slightly oblique at both ends, nearly equally inserted, the triangular teeth about as long. Peduncles about 1 mm. long and equaled by the bracts. Pedicels 5-7 cm. long, in the upper axils. Leaves 2-5 cm. long, all rather long-petioled, innumerable, narrow. Leaflets 3-5 pairs, oval to elliptical, rarely 5 mm. long, rounded, ashy with rather coarse stiff white hairs. sparse, appressed. Internodes very many, rarely 1 cm. long. Stems petioles and peduncles almost capillary, stems very many from a stout and erect root, much branched and forming delicate mats often a foot or two wide. Stipules small, rarely 3 mm. long. Though the pods are immature the plant is clearly new. No. 1082 Gorman from Ranch valley near Fort Selkirk on the Yukon in moist meadows, July 5 1899. The Ayan name is Kto-goonh. Distributed as *A. debilis*. No. 626 Miss Eastwood Whitehorse on the Yukon July 23, 1914.

29. *Astragalus Bourgovii* Gray Proc. Am. Acad. 6 227 (1864) Pods fully 15 cm long exclusive of the 2 mm. long stipe, from flattish to nearly round in cross-section, 4-5 mm. high, half-ovate-lanceolate to obliquely oblong-oblanceolate, acute at both ends. Flowers ascending, few, racemose, stout and thick, about 1-1.5 mm. long, purple. Banner 7 mm. long, ovate-oval, short and abruptly arched at the ends of the calyx teeth to 90 degrees. but little longer than the keel, with sides much reflexed. Wings little shorter than the banner, lanceolate, a little arched 1 mm. wide, narrower than keel. Keel 7 mm. long, straight, sharply rounded, 2 mm. shorter than the banner, purple above, with tip erect acute and 3 mm. high, a trifle shorter than the wings. Calyx tube oblong-campanulate, 3-4 mm. long, narrowed below, with mouth scarcely oblique, with teeth triangular to filiform-subulate and about half as long as tube. Pedicels slender, mostly twisted and with pod inverted, about as long as the calyx teeth and about 2 mm. long in flower, but the lower fruiting pedicels often 1 cm. long. Bracts ovate to subulate, delicate, 1 mm. long. Peduncles almost filiform, nearly all terminal, much longer than the leaves, about as long as the stems, 10-15 cm. long including the short rachis. Racemes short, spicate in flower, with about 5-10 flowers. Leaves not over 7 cm. long, slender, with lower petioles about as long as the leaf rachis. Leaflets acute at both ends, narrowly elliptical to oblong or lanceolate, not over 1-1.2 cm. long, 4 mm. wide, of 7-8 pairs, puberulent, nearly contiguous, reduced only at the ends of the leaves. Stipules scarious, 4 mm. long nearly wholly connate. Stems 1-2.5 dm. high, ascending, with internodes not over 2-3 cm. long. Root woody, crowned by many filiform and subterranean stems which form loose mats. Pubescence strigulose, sparse and short. This has the habit of *A. aboriginum* and resembles *A. debilis* but the leaves are more rakish and the leaflets sharp. Saw-

tooth Mts. southern Idaho and eastward to eastern Montana and northward to British Columbia, not in Utah, alpine and subalpine on rocky slopes, blooming in July and August. The type has very short stems. The less alpine forms have longer stems and leaves.

30. *Astragalus leptaleus* Gray Proc. Am. Acad. 6 220 (1864). *Phaca pauciflora* Nutt. *A. pauciflorus* (Nutt.) Gray. Pods rarely 1 cm. long, 3-4 mm. wide, chartaceous, a trifle inflated, elliptical-lanceolate or ovate to oval, acutish, abruptly contracted into a stipe about half as long as calyx, very shallow and widely-sulcate or flat dorsally, rather obcompressed, appearing as if nearly round in cross section, little oblique, sometimes a little curved and resembling small forms of *A. flexuosus*. Flowers 2-5, white (rarely purplish) on the ends of long and filiform axillary peduncles which are shorter than the leaves, about 1 cm. long. Banner obovate to oblong-obovate, about 7 mm. long, 4-5 mm. wide, notched, abruptly arched to 45 degrees at calyx tips, 2-3 mm. Longer than wings. Wings oblanceolate, 2 mm. wide, rather arched often to 30 degrees, 2 mm. longer than keel. Keel very short, about 2 mm. long and high, rounded to a half circle from base, very obtuse. Calyx tube about 3 mm. long, narrowed below, not oblique, a little longer than the subulate teeth and about as long as the filiform pedicel and subulate bract. Peduncles 2-5 cm. long. Leaves 7-10 cm. long, very narrow with ascending leaflets, and very delicate. Leaflets 7-11 pairs, lanceolate to elliptical, acute, distant, long-petiolulate, 7-12 mm. long. Stipules narrowly subulate, not reflexed, 4-10 mm. long, connate even on the uppermost nodes. Stems filiform, flexuous and very weak, rarely a foot long, often only a few inches long, the internodes rather short, minutely and sparsely pubescent but seemingly smooth. Whole plant very delicate, supported by the grass in the deep meadows in which it grows. Stems very few from slender running rootstocks as in *A. andinus*. This is equally rare with *A. debilis* and with the same wide distribution. Middle Temperate life zone. From Santa Fe New Mexico northward to British America. Westward to Gunnison Colorado, not as yet found in Utah nor the Great Basin. Monida, Somers, Bigfork Montana, Jones.

INFLATI.

Pods papery, rarely chartaceous, (coriaceous only in *A. Beckwithii*, *oocarpus*, and *lentiginosus* at times) conspicuously inflated (some forms of *A. lentiginosus*, *Palmeri*, and *pauciflorus* only slightly so), wholly 1-celled (except in *A. lentiginosus* which is variously 2-celled and *A. Beckwithii* and *triquetrus* have the dorsal suture raised within somewhat), the dorsal suture not at all produced (except as noted above), the ventral suture somewhat thickened and produced within and seed-bearing along the middle only, mostly sulcate ventrally and the suture nearly straight to concave or sometimes convex in the middle, the dorsal suture the more arched and rarely sulcate, pod tardily opening.

KEY

- A. Pods wholly 1-celled (dorsal suture a little intruded in *A. Beckwithii*)
- AB. Pods small, rarely 2 cm. long, sessile, jointed to a minute stipe in *A. pubentissimus* and *sabulonum*, never balloon-shaped. Calyx turbinate to campanulate. Flowers small rarely 1 cm. long.
- ABC. Densely tufted or cæspitose perennials. Flowers racemose, much arched, widely spreading or reflexed. Keel purple
Pods reflexed or horizontal. Leaves all petioled and crowded
Miseres.
- ABCD. Flowers 5-8 mm. long. Stipules connate high up and inclined to turn black in drying. Peduncles filiform, axillary, shorter than the leaves, over 2 cm. long. Leaves about 5 cm. long, with 4-6 pairs of narrowly elliptical leaflets about 1-2 cm. long which are cuneate at base and apiculate. Stems very slender, branched below, very many, 1-2 feet long, about prostrate, from a rather much branched root. Northern plants.
- Pods oblong, inclined to dry black, little inflated, much flattened.
31 *pauciflorus*.
- Pods nearly globose, not blackening, much inflated, not flattened.
32 *miser*.
- ABC2D. Flowers mostly barely 5 mm. long. Stipules not connate, broad and reflexed, small, not turning black. Pods very oblique but not arcuate, papery. Peduncles barely 1-2 cm. long and with rachis about as long. Leaves about 3 cm. long, with 3-5 pairs of oval to cuneate-obovate notched leaflets, not over 1 cm. long. Stems branching above, prostrate about a foot long or less, flexuous and with short internodes. Plants of the sagebrush plains at the eastern base of the Sierras.
- Whole plant softly long-hairy. 33 *Pulsiferæ*.
Plants ashy with closely appressed short hairs. 34 *diurnus*.

ABC3D. Flowers about 5-9 mm. long, purplish, rarely white, Calyx narrowly campanulate. Stipules not connate, rather wide, not turning black. Pods shaggy, with longer and denser hairs than on the leaves opening along both sutures at tip, obcompressed, narrow, conspicuously arcuate, inclined to be sulcate at both sutures, somewhat inflated, the dorsal suture double. Leaflets slightly if at all notched not evidently cuneate, short-petiolulate, about 1 cm. long, rather narrow. Plants of the Navajo and Green River Basins, growing in poor soil in valleys, Lower Temperate life zone. Often blooming as winter annuals. *A. desperatus* would be sought here when the pods are very thin.

Whole plant softly and densely hairy.

35 *pubentissimus*.

AB2C. Low annuals from a slender and erect root, widely spreading and much branched stems not elongated, with short internodes and numerous leaves. Flowers rather few and racemose on axillary peduncles shorter than the leaves. 5-8 mm. long, mostly white, much arched. Stipules not connate, small. Leaflets not over 7 pairs, narrow, thickish, obtuse. Pods very oblique, opening first at tip, mostly somewhat arcuate, pappy, wrinkled, reflexed except in *A. aridus*. Pedicels very short and about as long as the minute bracts. Calyx campanulate to hemispherical, about 2 mm. long. *Aridi*.

AB2CD. Pods strongly pubescent, but less so than the leaves with flat beak very short and mostly scarcely evident, obliquely oblong-ovate or half-oval-ovate, slightly inflated almost filled by the large seeds, hardly 1.5 cm. long, jointed to a minute stipe. Leaflets elliptical.

Plants appearing green but with short hairs. Pods rounded

below, barely flattened. Flowers about 7 mm. long. 36 *sabulonum*.

Plants hoary. Pods narrowed below and much flattened at both

ends. Flowers about 5 mm. long. 37 *aridus*.

AB2C2D. Pods only minutely pubescent when mature, hoary with very short hairs when young, very oblique, translucent and very thin and much inflated, conspicuously and very obliquely flat-beaked, about 2 cm. long and 1 cm. high or wide, reflexed. Leaflets linear or seemingly so by being folded.

Pods very oblique, half-ovate to lunate.

38 *Geyeri*.

AB3C. Slender, elongated plants, weak, mostly annual, internodes slender and leaves rather sparse, at least not very many. Flowers rather many in conspicuous racemes and about 1 cm. long, mostly purple, not conspicuously arched. Peduncles elongated and mostly as long as or longer than the leaves. Stipules not connate, small. Upper leaves short-petioled. Leaflets narrow, over 7 pairs. Pods with thin flat beaks, 1-2 cm. long, fully half as wide, inclined to be bellied in the middle, rarely at all obcompressed, pappy, rarely wrinkled. Pedicels almost none or short and bracts very small. Calyx campanulate, small, rarely 3 mm. long. Stems prostrate or decumbent. *Proriferi*.

AB3CD. Pods reflexed, chartaceous to membranaceous, not over 1 cm. long (2 cm. in one form of *A. Vaseyi*), somewhat oblique but with ventral suture always convex in the middle, triangular-narrowed at base (abruptly so at base) and apex, inflated in the middle till the cross section is round, not sulcate, with sharp beak, somewhat striquetrous below the flat tip, obliquely elliptical to oval, with both sutures evident and the ventral raised. Flowers many, spicate to

racemose, 7-10 mm. long. Calyx tube about 2 mm. long, obliquely attached (sometimes but obscurely so, with teeth subulate and about as long as the tube (short in *A. Metanus*). Peduncles about as long as leaves, the floral rachis twice as long. Leaflets about 2-3 cm. long, elliptical or narrower, mostly obtuse. Stipules adnate, reflexed. Stems striate, 1-2 ft. long, rather flexuous. Internodes 3-0 cm. long. Plants very pubescent except in *A. metanus*. Tropical life zone.

AB3CDE. Pubescence spreading. Leaflets moderately petiolulate.

Pods racemose. Flowers nearly white. Plants shaggy with partly spreading silky hairs. 39 *Julianus*.

Pods spicate. Flowers dark-purple. Plants hoary above with densely woolly hairs. 40 *priferus*.

AB3CD2E. Pods nearly glabrous, ventral suture humped in the middle and about one-half as convex there as the dorsal. Upper leaves sessile or nearly so. Leaflets about 9 pairs, 2-3 cm. long, distant, acutish, long-petiolulate, narrowly to linear-elliptic, flat. Pubescence closely appressed. Tall plants and probably shrubby.

Pods much flattened except at very base, 10 mm. long. 41 *metanus*.

Pods not flattened except at very tip. 2 cm. long. 42 *Vaseyi*.

AB3C2D. Pods 4-10 mm. long, reflexed in short and close racemes, very greatly inflated, globose-ovate, not at all oblique not compressed, not sulcate noticeably, not at all narrowed at base, the minute and flat tip scarcely visible. Stems ascending, annuals or winter annuals.

Pods jointed to a minute stipe, 6-8 mm. long. 43 *Thurberi*

AB3C3D. Pods about 5 mm. high and 12 mm. long, half-oval, inflated very little and only in the middle, much laterally flattened till nearly flat, erect and appressed. Apparently perennials of the Lower Temperate life zone.

Pods nearly flat. 44 *Palmeri*.

AB4C. Slender or tall plants with minutely woolly pubescence, stubby cream-colored flowers in dense spikes which do not elongate with age and on conspicuous peduncles which elongate with age. Leaves sessile, with many pairs of nearly contiguous leaflets, which are cuneate below. Pods taper-pointed. Tropical plants.

Pods rigid, small, little inflated, nearly smooth. Tall perennials.

45 *pychnostachyus*.

Pods papery, rather large, much inflated, hairy. Annuals. 46 *Hornii*.

A2B. Pods small, rarely 2 cm. long sometimes 3 cm. long in *pictus* and *subcinereus* very much inflated (somewhat so in *scalaris*), with cross section about round (deltoid-ovate in *scalaris*), tip but little flattened (decidedly so in *insularis*), reflexed, almost translucent and very thin, firm in *subcinereus* and *scalaris*, on a minute stipe shorter than calyx and mostly jointed to it. Mostly annuals, weak or low plants, erect.

A2BC. Annuals or winter annuals with very thin small racemose flowers, and low and spreading habit. Pods seemingly sessile

A2BC. Pods neither balloon-shaped nor stipitate nor stipe even a mere knob except in *A. Wetherilli* where it is as long as calyx, but on breaking away they leave a minute boss in the calyx as long as wide which sometimes elongates. Peduncles much shorter than the leaves. Triflori.

Pods very oblique, smooth, small. Weak annuals. 47 *insularis*.

Pods little oblique, 1-2 cm. long, mostly hairy. Winter annuals.

48 *triflorus*.

Pods 2-3 cm. long, conically pointed at least below. Stems

zigzag. Plants ashy.

49 *subcinereus*.

A2B2C. Perennials, rarely biennial.

A2B2CD. Pods only minutely stipitate, but inclined to be contracted at very base in addition.

A2B2CDE. Very delicate but erect plants with slender stems and filiform peduncles, and flowers in long and erect racemes. Pods very oblique and about 8 mm. long. *Scalares*.

Pods racemose, 4-8 mm. long. Tall, erect plants, intricately branched.

50 *scalaris*.

A2B2CD2E. Slender spreading plants with short internodes and many leaves, with filiform peduncles shorter than the leaves, few and racemose flowers, and translucent mottled tissue like pods about 2 cm. long and oval-ovate.

Pods over 1 cm. long, few. Low, weak and ascending plants.

51 *Wardi*.

A2B2C2D. Pods on a distinct filiform stipe about as long as calyx, but not jointed to it. *Picti*.

A2B2C2DE. Plants not from filiform rootstocks and leaflets not phyllodia-like but broad, at least not linear. Pods little if at all oblique.

Pods about 7 mm. long. Flowers greenish-purple.

Plants prostrate.

52 *serpens*.

Pods 1 cm. long. Flowers purple with white claws.

Plants erect or nearly so.

53 *nutans*.

A2B2C2D2E. Plants with filiform rootstocks and phyllodia-like leaflets. Well developed pods 3 cm. long, some smaller. Open and airy plants with slender and flexuous stems hardly a foot long, ascending. Peduncles much shorter than the leaves. Stipules very broad and small, not connate or only a trifle near the root. Flowers few, racemose, about 7-8 mm. long, rather light-colored. Bracts minute.

Plants with phyllodia-like leaflets and wiry underground stems.

54 *pictus*.

A3B. Pods large or long, 3 or more cm. long (2 cm. long in *A. oocarpus*, balloon-shaped and small in *A. jejunos*.)

A3BCD. Pods strictly sessile, and the calyx falling with it. Tropical plants. *Crotalariae*.

A3BCDE. Flowers white or cream-colored, thick and stubby, the erect part of banner very short and with sides reflexed but little. Petals nearly equal.

Whole plant hoary or woolly.

55 *vestitus*.

Whole plant nearly smooth.

56 *Pomonensis*.

A3BCD2E. Flowers purple or white, not stubby, the erect part of banner long and elliptical to oval, sides much reflexed, much longer than wings, and wings longer than keel. Flowers in oblong heads, ascending as are the pods, which are but little oblique. Pubescent plants. This

- group is probably nearest related to the lentiginosus group
 Flowers purple. Calyx teeth half as long as tube. Leaves
 and pods nearly smooth. 57 *Crotalariae*.
 Flowers light-colored. Calyx teeth as long as tube.
 Leaves densely white-woolly. Pods about smooth. 58 *Miguelensis*.
 Flowers purple-tipped. Whole plant silvery-silky. 59 *Magdalenae*.
- A3BCD3E.** Pods ovate, narrowed at base into a very thick
 pseudostipe, cartilaginous. Flowers white (cream-colored
 dry), about 1 cm. long, stubby and much arched, in loose
 racemes. Leaflets several pairs.
 Pods rigid, ascending 2 cm long. 60 *oocarpus*.
- A3BC2D.** Pods jointed to a minute boss within the calyx and
 so minutely stipitate (stipe is about 2 mm. long in *Wetherilli*),
 falling away from it readily, conspicuously ob-
 lique, the ventral suture mostly straight. Flowers short,
 arched and rather stubby, narrow in *A. Wetherilli* hardly
 1 cm. long, few and racemose. Stems decumbent, open,
 airy and branched below. Leaflets rather many, linear to
 narrowly elliptical (oval only in *Wetherilli*).
- A3BC2DE.** Pods a trifle obcompressed if at all flattened. Flow-
 ers white, (rarely purplish) Californian species. Tro-
 pical mostly. *Macrodon*.
 Whole plant softly-shaggy. 61 *macrodon*.
 Plants smooth or only ashy. 62 *Douglasii*.
- A3BC2D2E.** Pods a little laterally flattened, about half-ovate.
 Flowers few racemose, about 7 mm. long, ascending in
 bloom, purplish, rarely whitish. Peduncles with rachis
 rarely longer than leaves, 1-2 dm. long. Upper leaf peti-
 oles short or almost none. Leaflets long-petiolulate, 2-4
 cm. long. Stems flexuous, from a thick or woody root
 about 2 ft. long, spreading in tufts. Plants of the Navajo
 Basin and adjacent Colorado river drainage. *Allochroi*.
 Stipe minute. 63 *allochrous*.
 Stipe about as long as calyx. 64 *Wetherilli*.
- A3B2C.** Pods balloon-shaped, larger above (sometimes obscurely
 so), the cross section about round, little or somewhat oblique,
 mostly only apiculate at tip, conspicuously inflated and papery,
 tapering or contracted into a stipe at base (not tapering and
 sessile in *jejunus*) about as long as calyx. Stipules connate at
 least below. Leaflets linear (elliptical in *Hookerianus*) and
 mostly acute. Pubescent plants but never woolly. Perennials
 of the Lower and Middle, rarely Upper Temperate life zones.
- A3B2CD.** Pods nearly globose, sessile, about 1 cm. long. Stems
 caespitose and very short. Flowers not over 7 mm. long
 Leaflets revolute, sharp. *Jejuni*.
 Plants densely matted and nearly acaulescent, smooth. 65 *jejunus*.
- A3B2C2D.** Pods 2-5 cm. long, tapering at base into a distinct
 stipe as long as calyx but not jointed to it, sulcate ventrally
 Flowers a little over 1 cm. long, mostly rather capitate, 6-10,
 ascending. Banner large. Keel large, the base somewhat
 arched, tip acute. Fruiting calyx mostly reflexed, the tube
 about 3 mm. long and teeth never over half the tube. Up-
 per petioles short and leaf rachis long. Leaves rather ap-
 pressed, the middle ones the largest. Internodes 2-7 cm.
 long. Stems a half to 2 ft. long, tufted from rather woody
 root. *Hookeriani*.
 Tall, erect, smooth, plants with phyllodia-like leaflets. 66 *Cusickii*.
 Plants nearly prostrate, with silvery and rather
 broad leaflets. 67 *Hookerianus*.

A4B. Pods conspicuously stipitate.

A4BC. Pods not jointed to the stipe nor stipe jointed at the ends or in the middle, falling away with the stipe and calyx. Plants never smooth nor with leathery leaflets.

A4BCD. Pods completely laterally flattened except in the middle, acuminate at both ends, deltoid to triangular at tip, clavate, about 3-4 cm. long and fully 1 cm. wide, stipe about twice the calyx. Flowers many, racemose, ascending. Calyx tube cylindric, 7 mm. long. Pedicels stout, about 2 mm. long. Peduncles 1-2 dm. long, stout, floral rachis about as long. Oxyphysi.

Pods very flat, long-halberd-shaped.

68 oxyphysus.

A4BC2D. Pods half-elliptical to half-oval, about one third as wide as long, tapering into a filiform stipe about half as long as pod, 1.5-2.5 cm. long, ascending, not greatly inflated, smooth. This section is allied to the *A. stenophyllus* group. Tropical plants. Trichopodes.

Pods 1.5 cm. long, very slightly flattened in the middle. 69 trichopodus

Pods 2.5 cm. long, much flattened. 70 capillipes.

A4BC3D. Pods papery, abruptly contracted into a variable stipe, the body 3-4 cm. long (rarely 2 cm. long in forms of leucopsis) and at least half as wide as long (not over one third as long in fastidius but pod then abruptly contracted into a short stipe and 3-3.5 cm. long), not laterally flattened. Flowers white, rarely tinged with purple, in spikes. Tropical plants. Leucophylli.

A4BC3DE. Pubescence silky, of straight or only wavy and fine hairs, not woolly. Flowers rather thick and stubby. Calyx hyaline, cleft deeper above. Peduncles subterminal and stout.

Stipules not connate.

71 leucophyllus.

Stipules connate.

72 curtipes.

A4BC3D2E. Pubescence woolly, of kinked and tangled hairs, or when minute the hairs are spreading and leaf surface appears uneven.

Pods very obtuse at both ends, half-oval, with stipe 1 cm. long.

73 leucopsis.

A4B2C. Pods jointed to the stipe and mostly disarticulating at the joint. Leaflets thick and leathery, broad.

A4B2CD. Pubescence dense and hoary with stiff, closely appressed, straight hairs. Leaflets imbricated. Stems very short. Lutosi.

Flowers white, in axillary heads.

74 lutosus.

A4B2C2D. Pods mottled. Pubescence none except in forms of *A. megacarpus* on the calyx and young parts. Leaves inclined to be glaucous. Leaflets not imbricated, often round, small. Stipules not connate. Calyx white and hyaline. Wings elongated. Keel short, about as high as long. Pods with ventral suture raised externally. Plants very closely allied. Oophori.

A4B2C2DE. Pods papery, greatly inflated, 3-6 cm. long, 2-3 cm. wide, abruptly rounded at base and on a stipe hardly as long as calyx. Stems caespitose and almost none except in oophorus.

Stems very short and prostrate. Pods 4-6 cm. long. 75 megacarpus.

Stems 1-2 feet long, erect. Pods about 3 cm. long. 76 oophorus.

A4B2C2D2E. Pods coriaceous and rigid, somewhat inflated,

greatly obcompressed and arched, bisulcate ventrally, acuminate at both ends, dorsal suture a little intruded,

Pods arched, with sharp, raised ventral suture, acute at both ends.

77 Beckwithii.

- 2A. Pods triquetrous, partly 2-celled by the intrusion of the dorsal suture very thin and papery and almost translucent, half-elliptical, about 1.5 cm. long, sessile, reflexed in short racemes as are the flowers. Flowers about 5 mm. long, short and broad. Slender and low plants related to *A. Geyeri*. Triquetri.

Annuals.

78 triquetrus.

Perennials.

79 Craigi.

- 3A. Pods 2-celled or nearly so, by the intrusion of both sutures, inflated, not over 4 cm. long, normally papery, rarely coriaceous, normally ovate, rarely globose or linear, always arcuate or very oblique, not noticeably stipitate, jointed to calyx, mostly mottled, apiculate to acuminate, ovate to oblate in cross section, broadest and truncate at base or cordate there. Stipules small, not connate. Flowers never cream-colored, very variable in size but normally rather small, narrow and straight, not over 1.5 cm. long. Calyx short-cylindric, with triangular teeth. Plants blooming in early summer.

Pods 2-celled.

80 lentiginosus.

31. *Astragalus pauciflorus*. Hock. Fl. Bor. Am. 1 149 (1834). *A. vexilliflexus* Sheldon. *Tragacantha* Kuntze. Pods 5-10 mm. long, about 3 mm. high, conspicuously laterally flattened except in the middle, (the cross section elliptical), oblong to elliptical-oblong very shortly apiculate at both ends, puberulent, reflexed, with both sutures prominent and the ventral thick, not sulcate, convex on both sutures, or the ventral suture rarely straight, puberulent and ashy, splitting from the base through both sutures and valves falling apart, ventral suture only thickened within, walls rather stiff. Flowers like those of *A. montanus* but larger, 5-10 mm. long, 5-12, closely racemose, spreading to reflexed, purple or white. Banner oval to round, 4-8 mm. long, abruptly bent to erect at end of calyx, with sides reflexed about 1 mm. wide. Wings mostly white, lanceolate, 1-2 mm. shorter than banner, much arched, about as much longer than keel, purple-veined. Keel about 2 mm. long and high, abruptly erect, the obliquely truncate, tip triangular, incurved more than 90 degrees. Calyx tube Hedeoma-like, nearly turbinate, about 2 mm. long, acute and oblique at base, the subulate and curved teeth fully as long as tube. Pedicels filiform, often twisted, about 2-3 mm. long, as long as the delicate and subulate bracts. Leaves with petiole about half the rachis. Leaflets oblong to lanceolate or elliptical, acute, 3-4 mm. wide, 3-6 pairs. Stipules hyaline or black below, 3-5 mm. long. Plants ashy with rough and flattish hairs abruptly appressed. This grows with or near *A. tenellus* and can be separated by the sessile pods, with ventral suture less arched, mostly purple flowers, long bracts, petioled leaves and relatively few leaflets. From *A. Wingatensis* it is separable by its habitat, not spotted pods and leaflets not linear, and congested habit. Rather common in moist valleys along creeks from the bad lands of Nebraska and Dakota through Wyoming and northward and northwestward to the upper Waters of the Missoula and British America, at least as far north as the Cypress Hills. The flowers are often rather cleistogamous, and then minute and white. This has the habit of the *Debiles* and connects the two groups.

32. *Astragalus miser* Dougl. in Hook. Bor. Am. 1 153 (1834). *A. microcystis* Gray, *A. debilis* Walp., *A. amphidoxus* Blankenship. *Tragacantha* Kuntze. Pods about 6-8 mm. long, nearly globose rarely oval, mostly very obtuse but apiculate, a little oblique and with ventral suture about straight, conspicuously inflated, ashy with soft spreading hairs, apparently minutely stipitate but the stipe not longer than thick, with very thin and wrinkling walls. Flowers about 5 mm. long, pinkish or white, 6-10. Banner oval, about 4 mm. long, abruptly erect at end of calyx, rather hooded, and deeply notched, with many twin veins of purple coming from near the base, the sides only slightly reflexed, about 1 mm. longer than wings. Wings half-oval, rounded at tip about 1 mm. longer than keel, white, appearing very oblique. Keel blade deltoid wholly, except for a short and narrow base, about 2 mm. high, very obtuse. Calyx tube almost hemispherical, acutish at base, about 1 mm. long, the subulate teeth as long. Pedicels about 1 mm. long, half as long as the lanceolate and ciliate hyaline bracts. Peduncles 1-3 cm. long, and the rachis nearly as long. Racemes loose 5-12 flowered. Leaves 3-5 cm. long, with petiole rarely as long as lowest leaflets. Leaflets mostly obtuse, 4-6 pairs elliptical, rarely some are oval. Stipules narrowly triangular, about 5 mm. long. Internodes 1-2 cm. long. Whole plant even to pods and calyx softly ashy with rather short and wavy white hairs partly appressed. Base of stems decidedly woody. Along sandy bottoms from the eastern base of the Rockies to central Wyoming and northwestward through Montana to the eastern part of the Columbia Basin proper as far as Ft. Colville and northward into British America. Middle Temperate life zone. *A. miser* x *pauciflorus* is a hybrid form and about intermediate between the two species.

33. *Astragalus Pulsiferæ* Gray Proc. Am. Acad. 10 69 (1874). *A. Suksdorfii* Howell. Pods oblately half-round, about 1 cm. long and nearly as wide and high, with ventral suture about straight in the middle and then abruptly arched up at both ends. at base into a corner where it is sessile at right angles to the suture, and at tip into a flat and sharp upcurved deltoid beak 1-2 mm. long, translucent and tissue-like and wrinkled, greatly inflated, inclined to be a little sulcate ventrally along the middle, red stippled all over or green; cross section a little obcompressed, oval to oblate-oval, seed-bearing only in the middle. Flowers white, with waterlined banner a little shaded with purple, the banner about 3 mm. long, round, bent abruptly to about 110 degrees just beyond tube, with sides reflexed 1 mm. wide at base only and blade becoming rather fiddle-shaped: groove almost a half circle and filling the whole banner above; blade about 2 mm. longer than wings. Wings oblong, arched 30 degrees, 2 mm. wide, obtuse and with oblique tip, the right hand one incurved over keel and the other flaring, but the tips of both connivent over keel tip, fully 2 mm. longer than keel. Keel as in *A. miser*. Calyx about hemispherical, the tube hardly 2 mm. long, cleft deeper above, a little oblique at base, the subulate teeth lax, curved and as long to twice as long as tube. Pedicels filiform, 1-2 mm. long, about as long as the subulate bracts. Peduncles and leaf rachis filiform and very short. Stems stout for the plant, about 2 mm. thick. Root woody and thick at crown. Pubescence of whole plant white-shaggy with long and spreading rather kinked, soft hairs. Growing in poor gravelly soil from Chat and Plumas Co. California nearly to the British line. Middle Temperate life zone.

34. *Astragalus diurnus* Watson Proc. Am. Acad. 21 450 (1886). Pods obliquely ovate, or oblately half-ovate, about 2 cm. long and 1 cm. high, somewhat laterally flattened, with the ventral suture convex a little at tip and base and concave in the middle or straight, nearly square at the base and scarcely at all flattened, at tip very flat and with the deltoid beak about 3 mm. long and with declined tip,

ashy when young, nearly smooth when ripe, stiff-papery, flattish, or broadly sulcate along the ventral suture, the cross section nearly half-oval. Flowers 7-8 mm. long, few, white or tinged with purple above; the banner waterlined or purple-veined, 4-5 mm. long, variously arched beyond the calyx tips, about as long as wings. Wings half-obovate, acutish, quite oblique, about 2 mm. longer than keel, white. Keel half-cuneate with nearly square end and erect tip about 2-3 mm. high, a little colored at the end. Calyx turbinate-campanulate, about 2 mm. long, the teeth narrowly triangular and about as long as tube. Leaves rarely 5 cm. long. Leaflets oval to obovate, notched or very obtuse, 2-8 mm. long, smooth above, ashy below with short and closely appressed hairs, the calyx similar but with some black hairs intermixed. Stems quite slender, branching throughout, less than a foot long, apparently from underground stems. It has the habit of *A. Geyeri* and appears to be short-lived. John Day valley Oregon. Middle Temperate life zone.

35. *Astragalus pubentissimus* T. & G. Fl. 1 693 (1840). *A. multicaulis* Nutt., *A. Peabodianus* Jones, Phaca Rydberg. Pods ovate to lanceolate, 1-2 cm. long, about 7-10 mm. wide and 5 mm. high, decidedly obcompressed at base, much laterally flattened toward the deltoid to triangular, sharp, apiculate and upturned tip which is 1-5 mm. long, little if at all mottled, the cross section from triquetrous-reniform to transversely elliptical; jointed to a short stipe, walls very thin and wrinkled, hairy within. Flowers either dull purple or tinged with purple, ascending when fresh and gradually drooping with age, almost capitate or very shortly-racemose, several. Banner oval, abruptly arched to erect at calyx tips, the erect part about 4 mm. long, the sides much reflexed below, the central part white and purple veined. Wings obovate to lanceolate, notched, arched 30-45 degrees, fully 2 mm. wide, 1-2 mm. longer than keel and 2-4 mm. shorter than banner. Keel 3-4 mm. long, the base nearly straight, and the tip abruptly rounded to 110 degrees and deltoid and erect and rather acute, fully 3 mm. high, deep purple. Calyx tube about 3 mm. long, rather truncate at base and attached a little below the middle, cleft deeper above with broad sinus and teeth a little unequal, nearly subulate, arched and about as long as tube to twice as long. Pedicels about 1 mm. long and about as long as the minute triangular bracts. Peduncles hardly half as long as the leaves, 1-3 cm. long, the rachis a little shorter. Leaves innumerable (because of the many internodes which are rarely 1 cm. long), 2-6 cm. long, broad, the petioles about half the whole. Leaflets 3-8 pairs, mostly 5, broadly to narrowly elliptical, thick, contiguous, ashy (appearing as if minutely woolly) with partly spreading kinked rather appressed hairs, as is the whole plant except the shaggy pods. Stipules rather deltoid, rarely 3 mm. long. Stems rather coarse for the plant, round, a few inches to a foot or two long, forming mats on the ground, very many and much branched from a slender tap root. A short-lived perennial, but blooming the first year, growing in clayey or slightly sandy soil on flats from the upper Green river Basin Wyoming throughout the Navajo Basin to Farmington New Mexico and the San Juan and Henry Mts. Blooming in May and June. Lower Temperate life zone.

36. *Astragalus sabulonum* Gray Proc. Am. Acad. 13 368 (1878). *A. Virgineus* Sheldon. Phaca Rydberg. Pods oblong-ovate to half-oval, rounded at base, apiculate to shortly acuminate, arcuate to nearly straight, broadly sulcate dorsally, and sometimes so ventrally, little laterally flattened to slightly obcompressed, with cross section triquetrous-oval to nearly round; ventral suture raised and rather thick externally. Flowers (almost those of *A. Vaseyi*) 3-6, loose, about 7 mm. long, with petals 2 mm. longer than the calyx lobes. Banner arched abruptly to erect or 100 degrees at end of tube, with white tip or

all white and base purple, with purple midrib, purple-veined, notched, oval, about 5 mm. long, broadly and deeply grooved, with sides reflexed, one half mm. wide below. Wings white at tip and purple below or all white, obovate, arched to nearly erect, obtuse, concave to keel and connivent over the end, spreading on the lower side, narrowed and a trifle longer than the keel, and 2 mm. shorter than the banner. Keel dark-purple or brown, the base a little arched, the tip abruptly arched to 100 degrees and acutish, higher than long. Calyx tube campanulate, truncate at base, obcompressed at tip, not gibbous, nearly as long as the subulate lobes. Bracts subulate, green, hairy. Pedicels 1 mm. long, as long as or a little shorter than the bracts. Peduncles and rachis about as long as the leaves, the young ones as long as the young leaves. Leaves 5 cm. long, with petiole about one third the whole. Leaflets 4-12 mm. long, obovate to elliptical, about 4-6 pairs, green but decidedly pubescent with fine appressed hairs, hoary when young, hairs of the pods longer. Stipules slender, triangular, 2-3 mm. long. Stems 1-2 dm. long, the central one erect, the others variously spreading, flexuous, stout for the plant, annual or rarely blooming as a winter annual, with the aspect of *A. Geyeri* but more condensed. Internodes usually 1.5 cm. rarely 2.5 cm. long. Whole plant even to the pods short-shaggy with half appressed hairs, the leaves a little greener but all hoary, the hairs spreading on the pods. From the Moencoppa northern Arizona (Navajo Basin) and Lee's Ferry to Hawthorne and Rhodes Nevada and Imperial Valley and Indio California, growing in sandy deserts. Tropical and on the lower edge of the Lower Temperate life zone. Blooming in April. It is not easy to separate this from *A. pubentissimus* except by the habitat and life zone. The latter species has conspicuously arcuate pods and the pubescence finer and more wavy and much longer on the pods. Flowers also larger. The internodes shorter, and stems decidedly flexuous and flat on the ground.

37. *Astragalus aridus* Gray Proc. Am. Acad. 6 223 (1864). *A. albatus* Sheldon. Pods half elliptical, or obliquely ovate, shortly acute at both ends or at least narrowed below and acute at tip, mostly laterally flattened at both ends, 1-1.5 cm. long, 5-8 mm. high, ascending, with neither suture prominent externally, with cross section about round in the middle, the ventral suture straight or concave, the dorsal arched to a third circle, tip deltoid and flat, from scarcely evident to 3 mm. long. Flowers racemose, inclined to be cleistogamous, about 5 mm. long, few, rarely 10, at first dull-purple-tipped afterwards white or all white. Banner arched abruptly to erect at calyx tips, about 3 mm. long, with sides reflexed a little above, about 1 mm. longer than wings, white spot large and purple veined. Wings oblanceolate, about as long as keel, a little arched, one half mm. wide. Keel 2 mm. long, the base nearly straight and tip nearly erect and blunt, about 1 mm. high. Calyx tube turbinate, the longitudinal section deltoid, about 1 mm. long, not oblique nor apparently deeper cleft above, the teeth oblong to broadly triangular, barely acute, green, fully as long as tube or more. Pedicels almost none, shorter than the minute triangular bracts. Peduncles 2-4 cm. long, much shorter than the fruiting rachis which is sometimes 1 dm. long, but floral rachis short. Stipules inconspicuous, triangular, about 3 mm. long. Stems very many, rather slender, branching freely above, the outer ones prostrate the inner erect, flexuous, forming a dense mass 1-3 ft. wide and a foot high. Leaves 3-7 cm. long, the lower petioles rather long, the upper short, very many (the internodes rarely half as long as leaves). Leaflets 5-6 pairs, oblong-elliptical, rather distant. Whole plant even to calyx and bracts hoary with closely appressed very fine, tapering, silky, flat and twisted hairs, which are a little tangled on the young pods and resemble wool, but mature pods often with scattered pubes-

cence. This plant seems to hybridize with *A. lentiginosus* with which it often grows forming the *lentiginosus* var. *Coulteri*. Blooming in late spring, probably a winter annual at times. Tropical in sandy deserts. Common on the California deserts west of Yuma to Mexico and as far west as Indio.

38. *Astragalus Geyeri* Gray Proc. Am. Acad. 6 214 (1864). *Phaca annua* Geyer. Pods half-oval, half-ovate, or very broadly lunate, very oblique or arcuate and with tip often erect, from smooth to puberulent, sharply acute with a broad triangular to deltoid, incurved and flat rather oblique tip, decidedly laterally flattened, except in the middle, finely reticulated, rarely sulcate dorsally and then not deeply so, narrowed at both ends and abruptly so at base, greatly bellied below, the ventral suture even concave and the dorsal arched to about a half-circle, cross section triangular to deltoid and with rounded base. Flowers 3-5, about 7 mm. long, whitish. Banner arched to nearly erect at end of tube, about oval, 1-3 mm. longer than the wings, little notched with the sides reflexed somewhat, faintly purple-veined, white spot scarcely visible and coming within 1 mm. of the edge all around, groove shallow, scarcely narrower below. Wings 1-2 mm. longer than keel, obliquely ovate, obtuse, ascending about 30 degrees, 1-2 mm. wide. Keel about 2 mm. longer than calyx, with tip incurved to 100 degrees and deltoid, about 2 mm. high. Calyx campanulate, 1-2 mm. long, teeth triangular to subulate, green and fully as long as tube. Leaves 7-10 cm. long, all rather long-petioled, many. Peduncles filiform, 1-2 cm. long, axillary almost from the cotyledons. Leaflets linear to elliptical linear, 7-11 pairs, obtuse to notched, 1-3 cm. long, mostly folded, nearly smooth above, cuneate at base, rather distant. Plants ashy throughout with fine appressed hairs, but stems the most pubescent. Annuals with very slender erect roots and several stems from the crown, freely branching, flexuous, with very many internodes rarely 2 cm. long, blooming almost from the cotyledons throughout the season and at length becoming small bushy tufts often a foot high with horizontal side branches. Rarely blooms as a winter annual. Common throughout the Green River and Navajo Basins and throughout the Great Basin to the Sierras and northward to the southern side of the Columbia Basin, growing in sand on plains, Lower Temperate life zone. At the south it is replaced by *sabulonum* and *aridus*.

39. *Astragalus Julianus* Jones Cont. 7. 667 (1895). Pods obliquely oval about 12 mm. long, 7 mm. high from a little inflated to circular in cross section in the middle, beak acuminate, 4 mm. long and nearly central, ventral suture thick and not sulcate. Flowers nearly white but purple-tipped, in a close raceme which is lax in fruit, nearly sessile, reflexed, about 7 mm. long. Calyx campanulate, tube 2 mm. long, teeth subulate and as long as tube. Peduncles stout, as long as leaves, floral rachis as long as the peduncles. Leaves 1 dm. long proper petiole 1.2-2 cm. long. Leaflets 7-8 pairs, normally elliptical, acutish, 1.2 cm long, 2-3 mm. wide. Inflorescence corymbiform by the shortening of the upper internodes, plants mostly shaggy with partly spreading silky hairs except the shortly and sparsely pubescent pods. Stems erect or decumbent, about 1-2 ft. high. Internodes 13 cm. long. San Julio Lower California Brandegee.

40. *Astragalus proriferus* Jones. Cont. 5 275 (1893). Pods spicate, obliquely ovate to oval, 1-2 cm. long 7-10 mm. wide, chartaceous, inflated, rounded at base, early splitting the calyx, dorsal suture not evident, very convex, ventral little arched and much thickened in the middle, cross section broadly obovate, tip very flat and short, triangular, beak 4 mm. long. Flowers dark-purple, with lighter keel, spicate, 1 cm. long. Banner rather large, nearly round, ascending 80 degrees abruptly beyond the calyx tips, 2 mm. longer than the wings and keel, emarginate. Wings lanceolate, notched; keel 7 mm. long, tip abruptly erect or more incurved, acute, base a little arched. Calyx

broadly campanulate, tube 1-2 mm. long, oblique, cleft deeper above, teeth nearly as long as tube, subulate to triangular. Pedicels almost none but shorter than the obscure and ovate bract. Peduncles stout, one half as thick as stem, 5-7 cm. long, floral rachis. 7-10 cm. long, many flowered. Leaves 7-10 cm. long, petioles 2.5 cm. long or less. Leaflets 8-19 pairs, oblong-lanceolate, obtuse, 7-20 mm. long, 2-7 mm. wide, acute at base; stipules triangular, herbaceous, 4-7 mm. long, upper little reduced. Stems seemingly shrubby at base, 1 2 ft. long, ascending, whole plant hoary with very short and woolly pubescence which is very dense above. San Pedro Martir, Lower California, Brandegee.

41. *Astragalus metanus* Jones Cont 7 666, 733 (1895). Pods decidedly laterally compressed, lenticular, much the shape of the montanus group, obliquely ovate-elliptical, upper one third vetchlike, lower part swelled out by the few seeds, minutely puberulent, 10 mm. long, 5 mm. high, tip deltoid to triangular-acute, ventral suture nearly straight, narrowed at very base, cross section oval near the base. Flowers racemose, nearly sessile, purple at tip, horizontal, about 7 mm. apart. Banner 7 mm. long, bent abruptly 2 mm. beyond the calyx teeth to 45 to 90 degrees, oval, sides reflexed 1 mm. wide, most at base. Wings arched 30 to 60 degrees exposing the keel, oblong to oblong-lanceolate, 2 mm. shorter than the banner, narrower than the keel. Keel abruptly bent at tip to 110 degrees, about 1 mm. shorter than the wings, produced to a point, 3 mm. high, light-colored, with base a little arched. Calyx broadly campanulate; tube 2 mm. long, scarcely oblique at mouth; teeth triangular, about a third to half as long as tube. Pedicels not slender, 1 mm. long. Peduncles including rachis about a foot long, sulcate, normally 3-4 times as long as the leaves, often 5 dm. long. Leaves 10-15 cm. long with proper petiole 2-3 cm. long on the lower leaves and absent on the upper ones. Leaflets linear lanceolate, barely acute, not contiguous, 3-4 cm. long, thin. Internodes 7-10 cm. long. Stipules very small, green, 2 mm. long, reflexed, adnate, not connate. Stems prostrate from perennial roots, 2-3 ft. long, rather stout, sulcate. Plants minutely pubescent throughout with fine and appressed hairs fixed by the base. Hansen's ranch, Lower California near the boundary. Orcutt.

42. *Astragalus Vaseyi* Watson Proc. Am. Acad. 17 370 (1882). Pods obliquely ovate, often a little obcompressed below, flattened only at very tip which is short and deltoid, about 1 cm. wide, spicate, all on one side of the floral rachis as if pendent on ascending stems, 2 cm. long, usually with a little boss at base, when immature then often somewhat laterally compressed. Flowers spicate, the same as in *A. metanus* except that the calyx is campanulate and teeth as long as the tube. Peduncles with floral rachis rarely over twice as long as the leaves, not over 1.2 dm. long. Leaves rarely over 1 dm. long. Leaflets elliptical to narrowly so, flat, apiculate, rarely over 2 cm. long. Internodes seldom over 2-3 cm. long. Plants slender, flexuous, (said to be) shrubby at base, silvery throughout with closely appressed hairs except the minutely puberulent pods. On the California desert south of the Mojave river and east of the Sierras. Tropical.

43. *Astragalus Thurberi* Gray Pl. Thurber 312 (1855). Pods only minutely pubescent, about 6-8 mm. long, papery, faintly sulcate dorsally, nervose, rounded at base, widely spreading, with both sutures evident, jointed to a minute stipe. Flowers 4-7 mm. long, purplish to ochroleucous, many. Calyx tube campanulate, not gibbous, about 2 mm. long, teeth subulate and about as long as the tube. Bracts subulate, 2 mm. long longer than the pedicels, leaves many, rather appressed. Petioles one third to one half the whole. Leaflets 5-7 pairs, 2-10 mm. long, rather distant or crowded, narrowly oblong, obtuse, fleshy, retuse. Stipules triangular, adnate. Stems many spreading, rather stout, about a foot long, with short internodes, with many appressed branches below, rather rigid, leafy, apparently winter annual. Plants

minutely pubescent throughout with appressed hairs, blooming in March and April on the deserts of New Mexico and Arizona south of the Mogollons. Lower Temperate life zone probably.

44. *Astragalus Palmeri* Gray Proc. Am. Acad. 7 398 (1868). Pods deltoid-acute, obtuse at base, smooth. Flowers purple, many in racemes, about 5 mm. long, arched. Banner arched abruptly at end of tube to erect, about 3 mm long, oval, 1-2 mm. longer than wings, with sides reflexed a little. Wings oblanceolate, rounded, arched somewhat, about 1 mm. longer than keel. Keel with tip abruptly erect and 2 mm. high, obtuse. Calyx tube campanulate, about 2 mm. long, with teeth as long. Pedicels very short and as long as the triangular bracts. Peduncles erect, stout, about 1 dm. long, longer than the leaves, with racemes 1-1.5 dm. long. Upper leaves nearly sessile. Leaflets 8-13 pairs, oblong, 1.2-2 cm. long, obtuse, long-petioled. Stipules very small and short. Stems 1-2 ft. high, striate and rather stout. Plants ashy to nearly smooth. Growing on gravelly benches. Camp Grant southern Arizona. Palmer. Probable, Lower Temperate life zone.

45. *Astragalus pchnostachyus* Gray Proc. Am. Acad. 6 257 (1864). Pods oval ovate, chartaceous, rigid, and with thick rib-like sutures, about 7-10 mm. long, 5 mm. high and 2-3 mm. wide or wider, normally much laterally flattened and with cross section diamond-shaped, but sometimes nearly round, swelled only in the middle, rather coarsely reticulated, closely reflexed in a dense spike or oblong head, nearly smooth, pungently and stoutly and shortly acuminate-beaked, the beak upturned and with the style nearly as long as pod, both sutures very convex, with about 3 ovules. Petals about equal, much as in *A. Canadensis*. Flowers 7-10 mm. long, cream-colored, closely reflexed. Banner arched a little remote from calyx, about 4 mm. long, nearly round and with fleshy base, with sides reflexed in a narrow line. Wings oblanceolate, a trifle arched. Keel rather exserted, the lower side curved into a half circle or a little more, and the very broadly deltoid tip rather sharp, about 2-3 mm. high, dark. Calyx tube about 4 mm. long, cylindric-campanulate, truncate below, a little oblique at tip, about equally inserted, the deltoid teeth minute, felted white-woolly. Pedicels barely 1 mm. long, stout, much shorter than the hyaline and elongated subulate bracts. Flowering peduncles shorter than the leaves, in fruit often 1 dm. long, stout and strict, axillary. Leaves rarely 1 dm. long, arcuate. Leaflets thick, mucronate 10-20 pairs, oblong to narrowly elliptical, obtuse to notched, shortly-petiolulate, 1.5-2 cm. long. Stipules deltoid with a very broad base, adnate about 5 mm. long, scarious. Stems perennial, stout, strict, little branched, coarse, often woody, 4 ft high. Pubescence white-silky-woolly throughout except the pods. Blooming in the fall, growing in salt marshes near the coast from near San Francisco California southward.

46. *Astragalus Hornii*. Gray Proc. Am. Acad. 7 398 (1868). Pods ovate-acuminate from an abruptly rounded base, a little oblique, gradually acuminate to the tip from base, 1.5-2 cm. long, fully 1 cm. wide, the cross section about round, conspicuously inflated, papery and very thin, villous-pubescent when young, several seeded, densely set in an oblong head. Flowers 5-10 mm. long, about straight, narrow, nearly white, capitate, ascending as are the pods. Banner when fully developed narrowly elliptical, fully 4-8 mm. long, usually gently arched to 30 degrees beyond calyx, with sides reflexed 1 mm. wide around the margin and most below. Wings nearly linear, gently arched, about 1 mm. wide, acute or acutish, about 1 mm. longer than keel (or less), from fully 3 mm. shorter than banner to nearly as long. Keel with long claw abruptly rounded and tip a little incurved beyond, erect and about 3 mm. high, deltoid. Calyx tube campanulate, about 3 mm. long, villous, neither oblique nor gibbous nor truncate. Teeth triangular, about 2 mm. long. Pedicels stout. Bracts lanceolate and hyaline, about 2-3 mm. long. Peduncles in flower shorter than the leaves, in

fruit often 2 dm. long, spreading at about 30 degrees. Leaves 7-12 cm. long, widely spreading. Leaflets nearly contiguous, elliptical-linear to oblong-ovate, long petiolulate, not mucronate, nearly smooth, not over 2 cm. long, obtuse, 10-15 pairs. Pubescence scanty. Stipules very small, subulate, soon reflexed. All but the lowest internodes shorter than the leaves. Much branched slender annuals growing decumbent on alkaline flats in the San Joaquin valley and southward, common.

Astragalus Hornii var. Bajaensis (Sheldon Minn. Bot. Stud. 9 169 (1894) as species) var. *minutiflorus* Jones. *A. miserandrus* Greene. Pods 1 cm. wide, somewhat obcompressed so that in drying and pressing in herbarium material they are flat with the sutures in the middle, nearly oval, with a short and conical beak, a trifle sulcate ventrally, nearly smooth, veined. Flowers about 5 mm. long, stubby and petals all about equal. Calyx tube 2 mm. long, with blunt teeth much shorter than the tube. Peduncles slender, 3-5 cm. long, shorter than the leaves. Most of the leaves petioled, 1 dm. or less long. Leaflets thin, 6-11 pairs, oblong-obovate, not over 1 cm. long. Stems low and slender. This is a much reduced and delicate form from the borders of southern California and southward in Lower California. Sheldon's description would lead one to think that the pods were 2-celled and closely allied to *A. lentiginosus*, but the specimens on which his species is founded are wholly 1-celled and sutures approach each other only in the crushing of the normal shape by pressing.

47. **Astragalus insularis** Kell. Bull. Cal. Acad. 1 6 (1884). A triflorus var. *insularis* (Kell.) Jones. Pods decidedly oblique, not sulcate, smooth, about 1 cm. long and nearly as wide and high, obliquely ovate, rather narrowed below and with a flat deltoid beak about 3 mm. long. Flowers with blade purple-tipped, about 5 mm. long. Banner about 3 mm. long, oval, arched to 45 to 90 degrees beyond teeth, purple striped below as are the wings, with sides somewhat reflexed below, about 1 mm. longer than keel. Wings oblong, about as long as keel or a trifle more. Keel large, with straight base and then abruptly erect into a triangular and acute tip about 3 mm. high. Calyx tube almost hemispherical, about 1 mm. long, about as long as the triangular teeth, almost sessile. Bracts hyaline and minute. Peduncles 1-2 cm. long, filiform, the rachis somewhat longer. Leaves widely spreading, 5-10 cm. long, the petiole as long as the leaf rachis. Leaflets 3-6 pairs, linear-elliptical, apiculate, in the type about 1 cm. long, distant. Stems in the type much branched at base and running out very long, flexuous, very slender and tangled, annual. Cedros Island Lower California. Tropical.

Astragalus insularis var. Pondii (Greene Pitt. 1 288 (1889). as species.) This is a larger plant with rather strict stems and strict peduncles, not tangled, leaflets often 10 pairs and pods nearly oval. Bay of San Bartolomeo Lower California. Lieut. Pond.

Astragalus insularis var. Quentinus Jones Cont. 8 6 (1898). This is a very open and slender form with short peduncles, nearly globose pods with the flat tip reduced to a mere apiculation and pods about 2-2.5 cm. long and tissue-like, the leaves often 1.5 dm. long and with leaflets many and fully 2 cm. long. San Quentin Bay Lower California. This has been referred to *A. triflorus*, but that is a biennial or winter annual and does not seem to grow on the Pacific Coast.

48. **Astragalus triflorus** (DC.) Gray Pl. Wr. 2 45 (1853). *Phaca triflora* DC. Ast. 50 t 1 (1802). *Phaca Coquimbensis* H. & A. *Phaca Candolleana* H. B. K., *A. cerussatus* Sheldon, *A. triflorus* var. *Candolleanus* (H. B. K.) Jones. Pods 1-2.5 cm long, 7-10 mm. wide, almost oval, abruptly acute at both ends to barely acute at base, veiny only when old and then shortly-pubescent only, only a little oblique, the tip a mere apiculation sometimes flattish and little over 1 mm.

long, the general outline nearly oval, narrowly sulcate ventrally, mostly translucent. Flowers normally white, inclined to be cleistogamous, about 5-7 mm. long, the petals mostly but little longer than calyx. Banner notched, oval 2-4 mm. long, with sides little arched along the edges, about as long as keel or a trifle more. Wings oblong, nearly as long as banner. Keel very wide relatively, about 1.5 mm. wide below and at tip abruptly rounded to erect and but a little higher than the rest of keel and square. Calyx campanulate, the tube about 2 mm. long, the teeth arched, triangular and fully as long as tube. Pedicels stout, 1-2 mm. long, shorter than the delicate bracts. Peduncles 1-3 cm. long, the floral rachis about as long. Leaves 5-7 cm. long, ascending, on short petioles. Leaflets 5-8 pairs, folded, not contiguous, oblong, rounded at tip, about 1 cm. long. Stipules acuminate from a deltoid base. Stems 1-2 ft. long, rather many from the crown and branched below, with internodes shorter than the leaves. Pubescence soft throughout, spreading, hoary. The flowers vary greatly in color and length of petals. The banner is often arched to erect, with light-pink claw and blade striate-purple-veined and with darker edges. the groove is a half circle and occupies most of banner or broadly triangular, in some specimens the banner has a purple streak below the notch and on the sides. The wings equal the keel and ascending with tips just touching the keel tip, obliquely ovate and flat and obtuse. The keel tip is acute and narrow, pink but not purple-tipped. The wings are often light-pink and often purple streaked, usually darker below. Other material has dark-purple flowers with very striate banner. Some Colorado forms have the banner 2-3 mm. longer than keel and wings about intermediate. Frequent in the Lower Temperate life zone from Baker Lemhi Co. Idaho and the San Rafael Swell Utah to central Colorado and southward at least to central Mexico. The type locality is Mexico not Peru. Some forms are short-lived perennials. Blooms in summer. It grows in the hills and not on the plains in this country. DeCandolle's fanciful figure is poor, that of H. B. K. is better. On the plains it is replaced by the following. Gray's type is made up of *A. lentiginosus* var. *diphysus* partly.

The type of *Phaca triflora* DC. is a fanciful figure drawn as though it were a weak annual, but corresponds in essential features with the species. *Phaca Candolleana* H. B. K. which was intended to be the same thing is drawn without the root as though it were a perennial and has narrower leaflets but otherwise the same. It also is a fanciful figure. Plants from the Valley of Mexico by Schaffner are clearly annual and early blooming and fit DeCandolle's figure. Plants of my own collection at Casapalidá Zacatecas and Ramos correspond well with both figures showing the species to be a winter annual or flowering in the spring and fall from the same plant, a thing very common in Mexico, and plants inseparable from the Colorado form called *cerussatus* by Sheldon. The type is too near to *cerussatus* for it to be kept up as a variety. Plants corresponding to *cerussatus* from Mexico also are those of Rose from Irola No. 4558. At Baker Idaho I found it growing and in fruit in September and evidently in condition to live over the coming winter and thus at least a biennial. Parish sends me a form from Leastalk San Bernardino Co. California clearly perennial with mottled smooth pods and short calyx teeth. Plants growing in the San Rafael Swell Utah have the dense habit of *cerussatus* and fine and soft pubescence and beautifully mottled nearly globose pods, elongated calyx teeth and dark-purple flowers, appearing so like *A. pubentissimus* that only an examination of the pods and calyx teeth can separate them. These plants also bloom as annuals and winter annuals but the two species do not seem to hybridize. *A. Coquimbensis* answers fairly well to this species. The species is very variable in the pods and pubescence.

Astragalus triflorus var. **playanus** (Jones Cont. 8 6 (1898) as species) This is a robust form with pods about 3 cm. long, half-oval when young and always somewhat oblique. Pubescence almost none or minute. Leaflets nearly linear and 2 cm. long. Flowers white or purple. This is the common form of the plains of Texas, New Mexico and Arizona as far west as the Colorado river and northward to Flagstaff. It seems quite distinct from *A. triflorus* but cannot be maintained as it intergrades at all points. It is quite probable that it may grow in Lower California but all forms seen by me seem referable to *insularis*. *Playanus* is mostly a winter annual, rarely persisting longer. It blooms from spring to fall.

49. **Astragalus subcinereus** Gray Proc. Am. Acad. 13 366 (1878). *A. Wootoni* Sheldon. Pods rather stiff-papery, but not tissue-like, mostly mottled, 2-3 cm. long. oval to oblong-oval, a little gibbous, seed-bearing for most of the length, variously puberulent, large for the plant, sulcate about 2 mm. deep ventrally and often a little dorsally, base and tip inclined to be turned in opposite directions, either conically pointed at both ends or the tip sometimes only apiculate. Seed stalks about 2 mm. long. Flowers about 8 mm. long, stubby and much incurved after the fashion of *pictus* and *junceus*, rather dirty white and banner purple-veined, not over 10, in short racemes, spreading. Banner abruptly arched to erect near end of tube, oval, 4 mm. long, 2 mm. longer than keel. Wings little arched, oblanceolate, 1 mm. wide, barely a little longer than keel. Keel lunate the base and tip triangular acute and produced, base a little arched, and then abruptly rounded to erect, 3 mm. high. Calyx tube turbinate-campanulate, about 2 mm. long, minutely pubescent with wavy white and closely appressed hairs, tube attached in the middle of the fleshy end, a little oblique at tip and cleft deeper above, the teeth triangular and half to a third the tube. Pedicels in flower not over 2 mm. long and as long as the ovate bracts, but in fruit often 3 mm. long, inclined to be reflexed. Peduncles 1-3 cm. long, the floral rachis short in flower and flowers spicate, but elongating to sometimes 1 dm. long in fruit. widely spreading as are the leaves. Leaves slender, often 1 dm. long, all petioled but petioles short. Leaflets distant, linear (except the smallest ones), 7-9 pairs, folded, ashy below, nearly smooth above, retuse, 7-25 mm. long 2-3 mm. wide. Stipules not connate, thick, green, broadly deltoid, reflexed. Internodes 1-2 cm. long. Stems flexuous, single to few, rather stout for the plant, 2-4 dm. long, spreading, whole plants ashy. Winter annuals with slender roots. In the southern part of the Navajo Basin and running over a little on the Rio Grande drainage and following down the Colorado nearly to the mouth of the Virgin, growing on dry benches and sandy places Lower Temperate life zone. This is separable from *A. triflorus* by the ashy, not soft, pubescence, by the stiff and large pods, zigzag stems, open habit, and short calyx teeth. Presumably authentic material from Wooton himself in my herbarium and named by Wooton as *A. Wootoni* is *A. subcinereus*.

50. **Astragalus scalaris** Watson Proc. Am. Acad. 23 270 (1880). Pods 4-8 mm. long, 2-3 mm. wide and high, rather triquetrous, half-oval to oblong or oblong-ovate, straight but very oblique, strongly cross-nerved, papery, opening first at tip, deeply and broadly sulcate, with cross section triangular-cordate to almost reniform, smooth, about horizontal, truncate at tip by the abrupt ending of the ventral suture which is straight and with a minute upturned mucro, a trifle wider above and a little narrowed at base, evidently inflated though so small, splitting the calyx, on an evident but very short stipe. Flowers about 5 mm. long, very loosely racemose, many, white but purple-tinged above. Banner about 4 mm. long, nearly round, abruptly arched to 45 degrees at end of calyx, with sides reflexed 3 mm. wide to the midrib below, with conical and shallow groove, barely notched, hardly 1 mm.

longer than wings and 2 mm. longer than keel. Wings obliquely obovate a trifle arched 1 mm. wide, as wide as keel, very obtuse, concave to keel, spreading, nearly horizontal and the right hand one the more, at tip. Keel about 1 mm. long abruptly arched to a half circle, very obtuse. Calyx tube about hemispherical, deeper cleft above, 1-1.5 mm. long, nigrescent, a trifle laterally flattened, oblique at tip, with the deltoid teeth shorter than the tube. Pedicels slender, reflexed, about 2 mm. long. Bracts very thin and hyaline, shorter than the mature pedicels, triangular. Peduncles about 1 dm. long, often shorter than the floral rachis, in all the upper axils, sulcate. Leaves widely spreading, 3-10 cm. long, very delicate and quickly wilting, nearly sessile, with filiform rachis. Leaflets 6-12 pairs, linear-oblong to oval-ovate distant or not contiguous, 4-12 mm. long, conspicuously petiolulate, obtuse to retuse, 2-5 mm. wide, nearly smooth. Stipules minute, subulate, not connate. Stems biennial or short-lived perennials, 2-3 ft. high and racemosely branched from a woody and erect root. This has the habit of *A. Rusbyi* and the delicate and erect *Daleas*. The pods are nearly the shape of *A. sesquiflorus* (but reversed) and *leptaleus* and *Guatamalensis*, but is not related to any of them unless it be the latter. It grows among the oaks along streams in the lower edge of the Middle Temperate life zone, in the Sierra Madres of Chihuahua Mexico, at 6000 to 9500 ft. alt. Blooming in fall.

Astragalus scalaris var. *quercetinus* n. var. Pods conspicuously stipitate, the stipe about as long as calyx. Pedicels twice as long. Leaflets elliptical-ovate to oval-ovate. Plants about 3 feet high and with innumerable branches. Sierra Madre Mts. Chihuahua. San Diego Canon Sept. 16, 1903, Middle Temperate life zone. All sorts of intergrades occur.

51. *Astragalus Wardi* Gray Proc. Am. Acad. 12 55 (1876). Phaca Rydberg. Pods almost oval, inclined to be triangular-acute at both ends, straight, scarcely at all oblique. smooth, mottled, with round cross section except for a slight groove ventrally, the minute tip flattened and cuspidate, seed-bearing only in the middle and ventral suture intruded about one half mm., inclined to have a round false-stipe 1-2 mm. thick by the narrowing of the pod at the calyx but without anything but a mere rudiment of a true stipe. Flowers white or nearly so about 5 mm. long, ascending but soon pendent, arched as in *A. pictus*. Banner about 3 mm. long, arched abruptly to fully erect at calyx tips, greenish-white with tinge of yellow, purple-streaked below with fine lines; groove about 2 mm. wide and forming one third circle, about 1 mm. deep, a little shallower above and a little narrowed and deeper below; sides reflexed opposite the calyx tips a very little; blade oblong, to oval, rounded at tip and with sharp notch. Wings oblong-ovate, arched 45 degrees, narrowed at the almost acute and incurved tip about 2 mm. wide and 1 mm. longer than keel, and nearly 2 mm. shorter than banner, close-pressed to near the keel tip, then concave to it and the left hand one spreading with the lower edge turned out, the other bent over keel at tip and close-pressed to tip, not streaked. Keel a little deflexed at calyx tips, at the end sharply incurved to 115 degrees obtuse, yellow-tipped, barely 1 mm. longer than calyx, about 2 mm. high. Calyx obliquely campanulate, the tube about 2 mm. long, with base straight, and the upper side arched to near a quarter circle, attached on the lower acute corner which is fleshy, cleft a little deeper above, with a broad sinus, obcompressed at tip, with scattered black hairs, teeth subulate to triangular and about as long. Pedicels in fruit filiform, often 4 mm. long and longer than the delicate triangular bracts. Peduncles axillary throughout, filiform, shorter than the leaves, the floral rachis at least as long. 5-15 flowered. Leaves rarely 2 dm. long, lax and thin, the upper almost sessile.

Leaflets 8-10 pairs, narrowly oblong, obtuse to notched, cuneate below and long-petiolulate, 5-15 mm. long, not folded, thin, smooth. Stems ascending, about a foot high, very many, almost simple. Stipules triangular, small, hyaline, thin, the upper reflexed. Growing along irrigation ditches and moist bare bottoms and among willows in gravel and clay, from Richfield Utah to the head of the Sevier. My material from Willow Spring south of Lee's Ferry is probably this species. blooming in summer.

52. *Astragalus serpens* Jones Cont. 7 641, 644 (1895) Phaca Rydberg. Pods oval-ovate, 2-2.5 cm. long and about 1 cm. wide and high, round in cross section, barely sulcate ventrally, papery and much mottled but not translucent, conical-beaked, the beak not longer than high and minutely apiculate, rounded at base, the stipe hardly as long as calyx tube. Flowers greenish-purple, about 7 mm. long, rarely half a dozen and pods mostly single to a peduncle, the raceme about 1 cm. long and the stout peduncle only a little longer. Banner nearly round, about 3 mm. long, just equaling the wings and keel, abruptly arched to 110 degrees. Wings obovate-oval, very oblique, about 3 mm. wide and 4 mm. long, just the shape of the keel. Keel blunt, the base a trifle arched, the tip incurved to erect and with a minute boss, about 3 mm. high. Calyx narrowly campanulate, the tube 3 mm. long, teeth subulate, 2 mm. long. Bracts hyaline, about 2 mm. long, ovate. Pedicels, 2-4 mm. long, reflexed or spreading. Peduncles axillary. Leaves 3-4 cm. long, narrow, thick and stiff, many (the internodes rarely 2 cm. long), the relatively stout petiole about half the whole. Leaflets about 6 pairs, elliptical to oval, folded, thick, rounded and very obtuse, about 5 mm. long, contiguous. Stems caespitose and many from a thick and woody root, prostrate, freely branched, relatively stout, rarely 2 dm. long. Stipules brown and thin, deltoid, conspicuous, not connate, 3-4 mm. long. Whole plant ashy with short loosely appressed and rather tangled hairs, the calyx black-hairy. Loa Pass and Belknap Mt. Utah on high rocky ridges. Apparently in the Elk Mts. Utah. The material of *A. triflorus* from the San Rafael Swell Utah much resembles this but the pods are sessile and leaflets narrow. Middle Temperate life zone. Blooming in July.

53. *Astragalus nutans* n. sp. Pods as in *A. serpens* but translucent and only a little blotched, nearly globose. Flowers purple with claws about 1 cm. long, few and shortly racemose, horizontal to reflexed. Banner about 5 mm. long, oval, abruptly arched at end of calyx to 45 degrees, with sides reflexed about 1 mm. wide below, white spot purple striped. Wings obliquely obovate, rounded, 2 mm. shorter than banner and 1 mm. longer than keel. Keel with straight base and then rounded to a little more than erect, the tip nearly square at the corner, about 3 mm. high. Calyx tube campanulate, about 3 mm. long and 2 mm. high, the base straight, the upper side arched, inserted a little below the middle at the fleshy base, cleft deeper above and oblique at tip, the teeth triangular and about one-half to one-third the tube, pubescent with white and black hairs intermixed and closely appressed. Pedicels stout, 2-4 mm. long in fruit, rather longer than the ovate bracts. Peduncles 3-4 cm. long but shorter than the leaves, the floral rachis about half as long, in the upper axils. Leaves 4-5 cm. long, only the lower petioles as long as leaf rachis, many (the internodes 1-3 cm. long). Leaflets 3-6 pairs, elliptical, cuneate below, obtuse, 1-1.5 cm. long, often folded, not very thick. Stems 1-3 dm. long, rather slender, branched throughout, several from the tip of a slender erect not woody root, blooming the second year. Stipules small, triangular, rather hyaline, about 3 mm. long. Whole plant minutely ashy with closely appressed straight hairs. Growing in sand and blooming in May. Tropical. Providence Mountain eastern California. This has the habit of *A. triflorus* var.

playanus, but has a filiform stipe nearly as long as calyx. May 1902, Brandegee.

54. *Astragalus pictus* Gray Pl. Fend. 37. (1849) as *Phaca* and Proc. Am. Acad. 6 214 (1864) as var. *foliolosus*. *A. pictus* var. *angustus* Jones and *angustus* var. *pictus* and *A. angustus* Jones, *A. foliolosus* Sheldon, *A. ceramicus* var. *Jonesii* Sheldon, *A. pictus* Steud. was a nomen nudum and *A. pictus* Boissier & Gall. (1859) was a synonym of *A. conduplicatus* Bertol. (1864). The omission of Sheldon to see that *A. pictus* was never published though this fact was specifically stated by Gray (Proc. Am. Acad. 6 215) has led to several unnecessary synonyms. The type of this species is rare and so the general character of the species is given under the var. *magnus* which see. Pods oblong-oval, about 1.5 cm. long. Leaflets 3-7 pairs, linear and about 1.5 cm. long. Santa Fe New Mexico and extending over into the Navajo Basin to Moctezuma canon on the borders of Utah and to Moab.

Astragalus pictus var. *magnus* n. n. *A. pictus* Gray Proc. Am. Acad. 6 215 as to the description, not citation. My specimens no. 5160 from Silver Reef Utah constitute the type. Pods oval, inclined to be shortly-conical-acute at both ends, 2-3 cm long and 1-2 cm. wide and high, mostly shallow-suicate along the ventral suture, papery and inclined to be translucent, abruptly contracted at base into the stipe which is nearly as long as calyx tube, the tip inclined to be a little oblique and upturned but not always, pendent, few to single, seed-bearing along the middle, Flowers very light-dirty-purple and water-lined coarsely, about 1 cm. long, stubby. Banner round, about 5 mm. long, bent square off just beyond calyx tips to erect or a little more; groove very wide, a half circle, 2 mm. wide below, 3 mm. above: blade with branched purple veins and no white spot; sides reflexed but very little, not extending beyond the keel because of being so much arched. Wings barely longer than keel, very obliquely ovate with tip bent at right angles and acutish on the lower side or a little notched, about 3 mm. wide, wholly concealing keel. Keel with straight base then arched to a half circle and tip acuminate and erect, about 3 mm. high, and dull purple. Petals with white claws. Pedicels slender, 2-3 mm. long, and variable. Calyx tube turbinate-campanulate, about 2 mm. long, obcompressed above, rounded at base and equally inserted, sinuses broad and teeth subulate and a little shorter than tube, equal, not deeper cleft above. Peduncles filiform, spreading as are the leaves, 2-5 cm. long, flexuous, axillary, the rachis as long or longer and loosely few-flowered. Stems flexuous, very slender, rarely a foot high, with few internodes 1-3 cm. long, single at the ends of long and filiform rootstocks. Stipules green, triangular, erect, connate, rarely 5 mm. long, those of the rootstocks sheathing and without tips and often 1 cm. long. Lowest leaves very small and with about 3 pairs of oval to elliptical, contiguous leaflets 5 mm. long, or absent, the upper leaves with linear leaflets 2-5 cm. long and rarely 2 mm. wide, the uppermost leaflet a mere prolongation of the rachis and a trifle widened and longer than rest. Leaves, peduncles and stems about alike, all green, phyllodia-like. Frequent on sandy plains from western Nebraska through Wyoming to central Utah, Johnson's Pass Aquil Mts. (West of Faust) and Milford and southward to the Colorado river and eastward through central New Mexico to the plains of Kansas. Lower and part of the Middle Temperate life zone. Blooming in May and June.

Astragalus pictus var. *filifolius* Gray Pac. R. R. Rep. 12 part 2 t. I. A. (1860) as species, and Proc. Am. Acad. 6 215 (1864). *Psoralea longifolia* Pursh, *Phaca longifolia* (Pursh) Nutt., *A. ceramicus* Sheldon, *A. ceramicus* var. *imperfectus* Sheldon, *A. angustus* var. *longifolius* (Pursh) Jones. Leaflets either reduced to the filiform rachis or the

rachis with a few filiform leaflets. Stipe sometimes twice the calyx. Otherwise as in the var. *magnus*. More common.

55. ***Astragalus vestitus*** (Benth.) Watson Bib. Index 202 (1878). *Phaca vestita* Benth. Bot. Sulph. 13 (1844). This antedates *A. vestitus* Boissier A. Heldr. Diag. Pl. 1 pt. 9 98 (1849). *Tragacantha Kuntze*, *A. anemophilus* Greene. Pods from nearly oval to half-oval, rather angled than pointed at both ends, the tip being deltoid and very short in the type, variously spreading with dorsal suture barely sulcate and ventral decidedly so, often to one-third the depth, hoary to minutely pubescent. Flowers nearly in heads in the type, about 1 cm. long, wide and stubby, white or rarely purplish tipped, soon reflexed. Banner fleshy below and with thick claw, the tip oval and very short, arched remote from the calyx to nearly erect and with sides reflexed a trifle as a mere rim around the edge, the blade 5-7 mm. long, scarcely longer than the wings and keel. Wings oblong, nearly straight, rounded, little arched, veiny, about 1 mm. or less longer than keel. Keel with straight base and then abruptly erect, the tip broad and very obtuse, about 3 mm. high, purple. Calyx tube short-campanulate, about 4 mm. long and 3 mm. high, oblique at base and rather truncate, inserted near the middle, cleft deeper above, hoary, the triangular teeth about half the tube. Pedicels in the type almost none. Petioles absent or 3 cm. long. Leaflets 10-14 pairs, oval to elliptical, truncate to acutish, 1-2 cm. long. Stipules connate. Pubescence white-woolly in the type. A very variable species. Magdalena Bay Lower California.

Astragalus vestitus* var. *Menziesii (Gray Proc. Am. Acad. 6 217 (1864) as species). *Phaca densifolia* Smith, *A. densifolius* (Sm.) Torr. *Phaca Nuttallii* T. & G. Pods papery and rather translucent, 3-5 cm. long, 2-3 cm. wide and high, obliquely ovate to oval, puberulent, keeled ventrally and rather sulcate, reflexed, short-racemose. Flowers cream-colored, thick, about 1.2 cm. long, reflexed. Calyx tube shortly-cylindrical-campanulate, about 4 mm. long and nearly as high, cleft deeper above, slightly pubescent; teeth about half as long as tube and subulate from a deltoid base. Pedicels slender, 3-4 mm. long, equaled or a little surpassed by the the very thin and hyaline and narrow bracts. Peduncles 1-1.5 dm. long, mostly longer than the leaves and longer than the floral rachis. Leaves sessile or the lower only short-petioled, about 1 dm. long. Leaflets 15-19 pairs, elliptical with a cuneate base, rounded to notched, 1-2 cm. long. Stipules connate except at the uppermost nodes, papery and conspicuous. Stems erect to decumbent, from a woody base, rather stout, 2-3 feet long. Pubescence thinly woolly and soft throughout except on the calyx. Common on open hill sides and plains from San Francisco southward along the coast.

Astragalus vestitus* var. *Franciscanus (Sheldon Minn. Bot. Stud 9 133 (1894) as species). *A. Franciscanus* var. *longulus* Sheldon. *A. Crotalariae* var. *virgatus* Gray. *Phaca Franciscana* (Sheldon) Heller. Stipules connate only near the base of the stems. Pods many and often erect. Pubescence ashy or minute but evidently the rudiments of woolly hairs. Calyx lobes rather subulate and as long as tube. Same range as the var. *Menziesii* and freely intergrading. This variety is more strict and less inclined to be decumbent.

56. ***Astragalus Pomonensis*** Jones Cont. 10 59 (1902). Pods about 5 cm. long and nearly 3 cm. high and wide, about half-oval, conspicuously oblique, very blunt with a very short and deltoid tip not longer than wide, smooth when mature, ascending in dense swabs at the ends of stout peduncles which are about 1 dm. long and much shorter than the leaves. Flowers and calyx as in *A. Menziesii* in short spikes shorter than the peduncles. Leaves about 2 dm. long, sessile. Leaflets about 2 cm. long, oblong, a trifle wider below, truncate at tip and cuneate and long-petiolulate at base. Stems many and tufted.

decumbent, stout, 2-3 ft. long. Whole plant almost smooth, but calyx nigrescent. This plant varies but little, but is too close to *A. Menziesii*. Common in the valleys from Los Angeles and Pasadena to San Bernardino and Temecula.

57. *Astragalus Crotalariae* (Benth.) Gray Proc. Am. Acad 6 216 (1864). *Phaca Crotalariae* Benth. Pl. Hartw. 307 (1848). *Tragacanth* Kuntze. Pods oval, 2 cm. long and 1.5 cm. wide, about round in cross section, a little oblique, shortly pointed and apiculate, rather rigid. Flowers purple, about 2 cm. long. Banner elliptical, about 1.5 cm. long, arched gently to nearly erect a little beyond calyx tips, with sides reflexed below, about 4 mm. longer than wings. Wings linear, arched to 45 degrees, 2-3 mm. longer than keel. Keel half elliptical, the tip nearly erect. Calyx tube shortly campanulate, about 4 mm. long and short-pedicel, pubescent teeth triangular and half as long. Peduncles about 1 dm. long, heads 2-7 cm. long, loosely 6-12 flowered. Leaves about as in the var. *Menziesii* but larger and conspicuously pubescent only when young. Monterey California, Coulter. An obscure species.

58. *Astragalus Miguelensis* Greene Pitt. 1 33. (1887). Pods when mature about smooth, oval-ovate, about 2 cm. long, and 1.5 cm. wide, the triangular tip about 4 mm. long and arcuate, sulcate at both sutures, stiff-papery, ascending in dense heads and very shortly pedicel. Flowers about 1.5 cm. long, light colored. Banner oval, about 1 cm. long, arched abruptly at calyx tip to fully erect, thin. Wings linear, straight, about 1.5 mm. wide, about 3 mm. longer than keel and as much shorter than banner. Keel half-elliptical, about 5 mm. long, the tip ascending and acutish. Calyx tube about 5 mm. long and 4 mm high, short-campanulate, oblique at both ends, the teeth with deltoid base and nearly as long as the sparsely woolly tube. Leaflets 9-12 pairs, cuneate-oblong-obovate, rounded to notched, densely white-woolly. Leaves about 1 dm. long, mostly short-petioled. Peduncles 5 cm. to 1 dm. long, floral rachis short. Stems decumbent, branched. Stipules connate. This has much the habit of *A. vestitus* but the pods and flowers are capitate, and flowers not stubby and seemingly purple or purplish. Islands of Santa Rosa and San Miguel, California.

59. *Astragalus Magdalenæ* Greene Pitt. 1 162 (1888). *A. candidissimus* (Benth.) Watson. *Phaca candidissima* Benth. Pods minutely pubescent, 2-3 cm. long, oval the tip rather oblique or a little arched. Flowers purple-tipped, 1-1.5 cm. long, in a dense spike about 5 cm. long, almost sessile. Minute bracts twice the pedicels. Banner ovate, large, about 1 cm. long, arched at calyx tips to erect, 4 mm. longer than wings or less. Wings broadly lanceolate, little arched, about 2 mm. longer than keel. Keel about 5 mm. long, arched from base to tip in about one-third circle, nearly half-oval, about 4 mm. high. Calyx black-hairy, campanulate, the tube cleft deeper above. Teeth triangular and about half as long as tube. Peduncles one and a half times as long as leaves. Leaves 7-12 cm. long. Leaflets 8-15 pairs, obovate-cuneate to oblanceolate, not over 1.2 cm. long, rounded to notched, barely petiolulate, appressed-silvery-silky as is the whole plant except the merely puberulent pods. Stipules very small and not connate. Magdalena Bay Lower California, etc. It appears quite distinct but the species is very variable.

60. *Astragalus oocarpus* Gray Proc. Am. Acad. 6 213 (1864). This is founded on the figure of Torrey in Mex. Bound t. 17 and named *Crotalariaioides* there and called *Crotalariae* in the text p. 56 but not described. Pods rather thin-coriaceous, about 2 cm. long, 1.5 cm. wide and 1 cm. high, obliquely ovate, with flat upturned deltoid tip about 3 mm. long, slightly sulcate ventrally, not at all dorsally and with dorsal suture raised externally as thick ridge, smooth, only faintly reticulated, erect, several to many and racemose on a stout peduncle shorter than

the leaves; cross section, reniform. Flowers many, closely racemose, horizontal. Calyx campanulate-cylindric, 3-4 mm. long, a little oblique at the rounded base, not oblique above, with teeth minute and deltoid shortly pubescent. Pedicels rather slender, in fruit 2-3 mm. long and rather longer than the triangular bracts. Banner oval, about 8 mm. long, abruptly erect remote from calyx, with sides reflexed most below. Wings obliquely oblong-oblongeolate and very obtuse, about 3-4 mm. shorter than the banner and a trifle longer than the keel. Keel with straight base, then abruptly arched to erect at the end and tip triangular and acute. Leaves 1-1.5 dm. long, narrow, nearly sessile with 12-15 pairs of elliptical and obtuse and rather distant leaflets about 1 cm. long, thick and green, smooth. Stems 4-6 ft. high, branched above and flexuous and rather slender. Growing in the alkaline valleys east of San Diego California, seldom seen. Tropical.

61. *Astragalus macrodon* (H. & A.) Gray Proc. Am. Acad. 6 216 (1864). *Phaca macrodon* H. & A. Bot. Beech, 333 (1841). *A. holosericeus* Jones. Pods oval-ovate to half-oval, 2-3 cm. long and about 2 cm. wide, the oblique tip deltoid and short, a little sulcate at both sutures, chartaceous, spreading to reflexed, the cross section about round. Flowers ascending, nearly white, about 7 mm. long, 10-20 in a short and close raceme. Banner round, gently arched to erect from the calyx tube, with sides reflexed above, about 4 mm. long, barely longer than wings. Wings half-oval, a trifle longer than keel. Keel arched to a half circle from base, the triangular and produced tip as long as base and erect, about 4 mm. high. Calyx tube campanulate, about 3 mm. long, with subulate and curved teeth nearly as long. Bracts ovate, minute, shorter than the pedicels which are 2-3 mm. long. Peduncles slender, about half as long as leaves, the fruiting rachis at least as long. Lower leaves much reduced, the upper 1-1.5 dm. long, with petioles mostly 2-3 cm. long. Lower leaflets 5-7 pairs, linear-elliptical, acute, 7 mm. long, and petiole as long as leaf rachis; upper leaflets about 10 pairs, linear-lanceolate, very acute, 1-2 cm. long. Stipules subulate-filiform, 7 mm. long, reflexed, thick, not connate. Internodes 2-5 cm. long. Stems rather flexuous and slender. Pubescence very soft and short-shaggy throughout with very fine wavy hairs and seeming woolly but hardly so. Stems and pods less pubescent. Monterey Co., San Luis Obispo and the coast region, also at Fresno and around the San Joaquin valley.

62. *Astragalus Douglasii* (T. & G.) Gray Proc. Am. Acad. 6 215 (1864). *Phaca* T. & G. Fl. 1 346 (1838). A very variable species. Pods papery, 2-4 cm. long and about 3 cm. wide, in the type, gibbous-ovate to half oval, apiculate. Flowers cream-colored, rather reddish in bud. Banner oval-ovate, about 7 mm. high, abruptly arched at end of calyx to erect, with sides reflexed near the base and 1 mm. wide; groove sharply widened at end of keel till it fills the whole banner, the banner tips not reflexed. Wings sharply arched to nearly erect and exposing keel, very obliquely cuneate obovate, about 3 mm. wide near tip, very blunt, the right hand one flaring below, the other close pressed to keel, about 1 mm. longer than keel and 3 mm. shorter than banner. Keel as high as long and abruptly rounded to a little more than erect and sharp, about 3 mm. high, not dark-tipped. Calyx nearly hemispherical, oblique at both ends, inserted near the lower corner and fleshy at corner, at mouth obcompressed and deeper and broader cleft. Upper teeth the longer, subulate, rather deltoid, hardly one-third as long as tube. Flowering pedicels about equaled by the ovate bracts, 1-2 mm. long. Peduncles slender, rarely 1 dm. long. Leaves narrow, 1-1.5 dm. long, all somewhat petioled. Leaflets 10-13 pairs, 7-20 mm. long, narrowly elliptical to linear-oblong, obtuse, rather thick, about 4 mm. wide, shortly petiolulate, inclined to be silvery below with very fine straight and closely appressed hairs, but

pubescence very variable. Stipules rather scarious, with deltoid base and subulate tip, rarely 5 mm. long. Stems rather prostrate and with ascending tips, many from a thick and fleshy root, flexuous, 2-3 ft. long, growing on flats where it is rather alkaline. Being the first green things in the spring this species has the reputation of being a loco weed. From the southern San Joaquin valley to southern California, and San Pedro Martir, Lower California, Lower Temperate life zone, in the interior, mostly.

Astragalus Douglasti var. Parishii (Gray) Jones Cont. 8 6 (1898). *A. Parishii* Gray Proc. Am. Acad. 19 75 (1883). Pods oval to oblong, oblique, usually apiculate, often 5 cm. long, smooth to minutely pubescent, nearly round in cross section. Flowers white. Banner 2 mm longer than keel, 1 mm. longer than wings. Wings oblanceolate, narrower than keel. Keel about 4 mm. high. Calyx teeth from half as long as tube to very short. Leaflets 7-10 pairs, elliptical, obtuse, 2-3 cm. long, silvery-pubescent below. Stems about 2 ft high. From Antelope Valley southward along the mountains.

Astragalus Douglasii var. glaberrimus Jones Cont. 7 645 (1895). Pods half-oval, shortly and triangular-flat-beaked, 2.5-4 cm. long, round in cross section, reflexed. Flowers 6-10. Racemes very lax. Peduncles 1-1.5 dm. long including the rachis which is two-thirds the whole. Leaflets about 7 pairs, linear-lanceolate, very sharp-pointed, 1-2 cm. long, 2 mm. wide, distant. All but the very uppermost leaves petioled. Plants rarely a foot and half high, rather bushy branched at base. San Fernando and Los Huevelos Lower California, Brandegee.

Astragalus Douglasii var. piscinus Jones Cont. 7 645 (1895) and Cont. 10 61 (1902). Pods obliquely ovate-oblong, 2 cm. long, 1.2 cm. wide, rounded at base, papery, sulcate ventrally, shortly acute, round in cross section, nearly smooth, ascending. Flowers purple, 1 cm. long, loosely spicate-racemose, almost sessile. Banner ascending sharply to 45 degrees remote from calyx tips, with sides reflexed. Wings about 7 mm. long, lanceolate, arched 30 degrees, a trifle longer than keel. Keel 1 mm. shorter than banner, 7 mm. long, large, arched to erect. Calyx broadly campanulate, 2 mm. long and wide, twice as long as the triangular teeth. Pedicels very short and a half shorter than the ovate bracts. Peduncles floriferous on the upper third, the racemes 5-10 cm. long, stiff. Leaves sessile. Stems erect. Stipules minute, not connate. Whole plant almost smooth. Lagoon Head Lower California, Palmer.

Astragalus Douglasii var. Tejonensis Jones Cont. 7 644 (1895) and Cont. 10 61 (1902). Pods mostly ascending, half-oval-ovate, 2.5-4 cm. long, 2-3 cm. wide, nearly round in cross section, variously reticulated, nearly smooth when ripe. Flowers like the var. *Parishii* but banner not elongated. Keel tip but little incurved and broader. Calyx lobes subulate and half as long as tube. Flowers racemose, usually ascending, often distant. Floral rachis in flower 5-7 cm. long, in fruit 10-15 cm. long. Peduncles and rachis 1-2 dm. long, finely sulcate as are the stems. Leaves and leaflets as in *Parishii* but leaves 7-13 cm. long and ascending. Leaflets 10 pairs, not over 2 cm. long, elliptical to oblong-lanceolate, rounded at tip, 4-5 mm. wide. Proper petioles present. Plants green throughout seemingly but really with the same minute pubescence but less evident. It is readily separable from *Parishii* by the small-cream-colored flowers, long calyx lobes, broad leaflets and green appearance. This is the common form along the mountains north of the San Bernardinos. *A. Douglasii* can be separated from *A. macrodon* only by the pubescence.

63. **Astragalus allochrous** Gray Proc. Am. Acad. 13 366 (1878) *A. Wootoni* Sheldon. Pods half-oval, thin-chartaceous, slightly if at all sulcate, apiculate and barely acute, faintly and rather closely reticulated, apparently smooth when ripe but really minutely puberulent, about 1.5 cm. high and 3 cm. long, with ventral suture convex only

close to calyx, jointed to a minute stipe at base, ascending or reflexed, both sutures evident and nearly alike, the ventral intruded 1 mm. deep or less; seed talks as long as the obliquely reniform seeds which are nearly 2 mm. long and brown. Flowers racemose, 10-15. Banner 1-2 mm. longer than keel, nearly round, notched, with sides reflexed below, arched in an abrupt curve from calyx tips to nearly erect. Wings nearly linear, arched and exposing keel, a little longer than keel, oblique. Keel ascending, about reaching to calyx tips, abruptly bent at tip to 90 degrees and acutish. Calyx tube faintly 5-nerved, ashy campanulate, not gibbous, 3 mm. long and as long as the subulate teeth or a little longer. Bracts ovate, acute. Pedicels erect in flower and reflexed variably to horizontal or more in fruit, 4 mm. long, usually twice the bracts, stout. Peduncles angled, stout in fruit, erect, including floral rachis 12-15 cm. long and floriferous on the upper third. Leaves 5-10 cm. long, nearly sessile. Leaflets 6-9 pairs, linear-oblong, barely obtuse at tip and base or notched above, all on the upper side of the rachis, about 1 cm apart. Internodes about 2-3 cm. long, the lowest ones 5-10 cm. long. Stems rather coarse, 2 feet high, tufted, decumbent, angled. Plants very minutely puberulent, the young pods, pedicels and peduncles hoary at first. From the Organ Mts. New Mexico to the Colorado through the Mogollons. Lower Temperate life zone. Growing on gravelly and dry benches or along dry watercourses. This is hard to separate from robust forms of *A. triflorus* except by the larger purple flowers and evidently perennial roots from a rather woody base. Plants distributed by E. O. Wooton from Mesilla Valley April 20 1905 as *A. Wootoni* Sheldon are this species, also No. 34 Metcalf from near Silver City New Mexico distributed as *A. playanus*. It is quite possible that Sheldon's type was mixed with *A. subcinereus*.

64. *Astragalus Wetherilli* Jones Cont. Cont 4. 34 (1893). Phaca Rydberg. Pods ascending, shortly acuminate, half-oval-ovate, about 2-2.5 cm. long and 1 cm. wide and high, very slightly flattened laterally and cross section nearly round but flat along the ventral suture, not sulcate, chartaceous, rounded at base and jointed to the tip of a slender stipe nearly as long as calyx, sometimes reddish but not mottled. Flowers about 1 cm. long, narrow, white or only purple tinged, almost in heads, ascending. Banner about 6 mm. long, oblong, abruptly arched remote from calyx tips to 45 degrees, 2 mm. longer than wings, with sides reflexed about 1 mm. wide. Wings nearly linear, arched to nearly 45 degrees, obtuse, a little longer than keel. Keel with straight and narrow base about 1 mm. wide, the tip sharply rounded to a half circle and very obtuse, 2 mm. high, purple at tip. Calyx narrowly campanulate, the tube about 3 mm. long, acute at base and attached on lower corner, the subulate teeth nearly as long as tube, nigrescent. Pedicels stout, nigrescent, 2-3 mm. long, about as long as the triangular bracts. Peduncles slender, 2-4 cm. long erect fruiting rachis 1-2 cm. long and rarely with more than 3 pods and half a dozen flowers. Leaves 4-5 cm. long, slender and thin, all petioled, the lower petioles more than half the whole, the upper nearly half. Lower leaflets nearly round and shortly-cuneate at the long-petiolulate base, upper leaflets broadly elliptical, about 1 cm. long, flat and thin, rounded, 4-5 pairs or the upper 6-8 pairs, almost smooth. Stems slender, in dense tufts at much branched woody base, ascending, flexuous, about 2 ft. high. Stipules small, not connate. Peduncles in most of the axils. Along the Grand River near Grand Junction Colorado, and to Moab, Utah, Miss Eastwood. Lower Temperate life zone.

65. *Astragalus jejunos* Watson Bot. King 73 (1871). Phaca Rydberg. Pods nearly smooth, mottled when in the sun, flattish to a triflo sulcate ventrally, faintly triquetrous when fresh, a little laterally flattened, merely apiculate, apparently jointed to a minute boss in the calyx and early falling from it, very translucent and delicate in texture. Flowers 2-3, purple-tinged, about 1 cm. long. Flowers al-

most the same as in *A. simplicifolius*, the banner oval and arched to erect, the bulge behind less evident, white spot the same, sides little reflexed. Calyx campanulate, about 1 mm. long, the triangular teeth hardly as long. Peduncles shorter than the leaves, filiform, rarely 5 cm long. Leaves strict, not over 7 cm. long, with rigid ascending leaflets and short petioles. Leaflets 2-5 mm. long, thick, 4-8 pairs, grooved, sharp, sessile, the terminal one mostly not jointed to the green rachis, and like it. Petioles persistent after the leaflets fall and rigid. Pedicels 1-3 mm. long. Bracts small. Stipules conspicuously connate throughout, hyaline. Stems an inch or so high, much branched, many from the crown of the thick and erect root, with the stipules overlapping to the tip of the stem. Growing in clay soil on bare ridges of the bad lands of western Wyoming north of the Uintas. Middle Temperate life zone, along with *Gutierrezia*, *Aplopappus acaulis*, *Cogwellia* etc.

66. ***Astragalus Cusickii*** Gray Proc. Am. Acad. 13 370 (1878). Phaca Rydberg. Pods racemose, elliptical to obovate, nearly straight, not sulcate, translucent and very thin and papery, with oily drops within, red-nerved and stippled above, horizontal to pendulous, 3-4 cm. long, about 2-2.5 cm. wide, compressed at base, splitting with age from tip to base and through the pedicel along the dorsal suture, also along the ventral suture at tip and base, but not through the seed bearing portion, tip very shortly triangular or deltoid and oblique, 1-4 mm. long, cross section half-oval, shallow and very broadly sulcate ventrally. Stipe not longer than calyx and not jointed to it and so pod is persistent even through the winter on dead stems. Flowers coarse, about the same as *A. stenophyllus*, nearly horizontal, loosely spicate, rather few, 1-1.5 cm. long, white turning to cream-colored with age. Banner fiddle-shaped by being much contracted about one third the way from the base, oval, 1 cm. long, arched to 90 degrees 2-4 mm. beyond the calyx teeth, erect part about 7 mm. long, a little hooded at tip, water-lined, with fleshy claw, with sides reflexed to 2 mm. wide in the middle only, with groove very deep and narrowed below and flattening out above. Wings arched from little to 30 degrees, obliquely oblong-lanceolate, 1-3 mm. longer than keel and 2 mm. shorter than banner, about 4 mm. wide below the keel tip and tapering down above concave to keel, flaring beyond. Keel a little arched, about 4 mm long (blade), abruptly rounded to nearly 90 degrees, yellow, with tip acute and about 3 mm. high. Calyx tube a little oblique at base and with pedicel inserted below the middle of the end, truncate, scarcely at all compressed, white, straight, 3 mm. long, broadly campanulate, with mouth oblique, with teeth rudimentary and deltoid, one half mm. long. Bracts minute and hyaline. Pedicels stout, short, some of them reflexed. Peduncles subterminal, stout, long, green, sulcate, a foot or less long. Leaves not over 1 dm long, few, spreading, lax, nearly sessile, with green and rush-like rachis. Leaflets deciduous, linear to filiform, minute to 2.5 cm. long, distant, petiolulate, the terminal one the simple rachis or slightly enlarged rachis or a leaflet barely jointed to it, 6-8 pairs. Stipules small, not connate except at very base. Stems erect, sulcate, 1-2 feet long, rather slender, flexuous, whole plant appearing smooth but really minutely pubescent. Grows in dense tufts on dry rocks on south slopes in Snake river canon at and below Huntington Oregon. Lower Temperate life zone. Plants with the habit of *A. stenophyllus*, and stems much as in *A. junceus*.

67. ***Astragalus Hookerianus*** (T. & G.) Gray Proc. Am. Acad. 6 215 (1864). Phaca *Hookeriana* T. & G. 1 693 (1840). This antedates *A. Hokerianus* Dietr. *A. Sonneanus* Greene. Pods 3-6 cm. long, 2-3 cm. wide, mostly oblong-obovate, a trifle obcompressed when fresh, tapering into the stipe, very round at tip and minutely apiculate, finely reticulated, variously mottled, hardly at all oblique, cross section oblate-round. Flowers in loose or dense heads, inclined to be

purple-tipped, about 1 cm. long. Banner very large, nearly the whole of it erect, about 8 mm. long and almost round, arched gently, 2-7 mm. longer than keel, with sides reflexed 1 mm. wide. Wings broad, oblong to lanceolate-lunate, about 3 mm. wide, rounded, arched about 30 degrees. Keel 7 mm. long, as long as wings, dark-tipped, produced and with a long acute and erect tip 1 mm. wide. Calyx tube nigrescent, reflexed, short-campanulate, 3 mm. long, nearly sessile, scarcely oblique and the base slightly narrowed, not flattened, with rounded sinuses; teeth triangular to subulate, unequal, conspicuous, about 2 mm. long. Pedicels very short and stout. Bracts ovate, 2 mm. long. Peduncles 5-15 cm. long, hardly longer than the leaves, many, in most of the axils. Leaves 5-10 cm. long, the petiole almost none, short or not over 2 cm. long. Leaflets 6-10 pairs, normally about 7 mm. long, rarely 2.5 cm. long, ovate to linear, rather thick, acutish to rounded, with prominent midrib, green. Stipules rather large, green or purple above, smaller and connate below. Stems decumbent at base, rarely a foot long, much branched at base and from long underground stems, but from a stout and erect root. Internodes rather short and leaves many mostly. Whole plant pubescent with partly spreading soft and fine hairs, but variable. This grows on rocky ridges and among sagebrush from the Middle Temperate to the Upper Temperate life zone, sometimes seemingly alpine but not truly so. Common in the Sierras and northward from Reno, possibly in the Blue Mts. Oregon.

Astragalus Hookerianus var. **Whitneyi** (Gray) Jones Cont. 7 668 (1895). *A. Whitneyi* Gray Proc. Am. Acad. 6 526 (1865). *A. Whitneyi* var. *pinonis* Elmer. Pods about 2 cm. long and 1.5 cm. wide. Flowers purple. Calyx teeth about 1 mm long. Leaflets 5-9 pairs, linear-oblong, 4-12 mm. long. Whole plant nearly smooth. Same range as the type but mostly in the high peaks but farther south. Tuolumne Co. and Ventura Co. California.

68. **Astragalus oxyphysus** Gray Proc. Am. Acad. 6 218 (1864). Phaca Heller. Pods nearly boat-shaped, half-elliptical, with ventral suture convex in the middle and concave toward the ends, dorsal suture very convex, the calyx ascending but pods somewhat drooping, papery, appearing smooth and translucent. Flowers about 15 mm. long, white, narrow, ascending. Banner oblanceolate, gently arched to erect beyond calyx tips, the sides reflexed about 1 mm. wide, 3-4 mm. longer than wings. Wings linear, gently arched to 45 degrees about 2 mm. longer than keele. Keel about 5 mm. long, with long, exserted claw, the base nearly straight, then gently rounded to nearly erect with a broadly triangular and very obtuse tip about 3 mm. high, not dark-tipped. Calyx scarcely gibbous, acutish at base and fleshy at the insertion with the very thick pedicel, cleft deeper above, with subulate teeth about 2 mm. long. Leaves 1-1.5 dm. long, narrow, very short-petioled. Leaflets 4-10 pairs, not contiguous, 1-2 cm. long, narrowly elliptical, apiculate and obtuse. Internodes about 3 cm. long. Stems flexuous, about 2 ft. high, branched below and woody, nearly erect. Pubescence woolly-hoary and appressed. Dry hills throughout the San Joaquin valley and over to San Luis Obispo.

69. **Astragalus trichopodus** (Nutt.) Gray Proc. Am. Acad. 6 218 (1864). Phaca trichopoda Nutt. in T. & G. Fl. 1 343 (1838). Pods about 1.5 cm. long, and 6 mm. wide and high, with cross section about round, half-elliptical, about equally triangular-acute at the ends, not at all laterally flattened, in short spikes as are the flowers. Flowers white, stubby, about 1 cm. long. Banner with erect part short and rounded and arched remote from calyx tips. Keel and wings about equal, nearly as long as banner. Calyx campanulate, about 2 mm. long, nigrescent, with triangular teeth from a deltoid base about one third as long as tube and with broad sinuses. Pedicels slender, 2-4 mm. long, longer than the bracts. Peduncles 1-1.5 dm. long, slender.

Leaves nearly sessile, about 1 dm. long, narrow. Leaflets 10-14 pairs, narrowly elliptical, about 1-1.5 cm. long, obtuse. Stems weak and short, decumbent, floriferous throughout, with slender internodes, about a foot long. Stipules small. Pubescence rather scanty, appressed and nearly straight. Santa Barbara and Catalina Island California. Nuttall, Lyon. The type species has rarely been collected. In it the stems are stouter and appearing as if erect. Species confused with the next by Gray and with *A. Antiselli*. Specimens sent out as typical got by Gray from Santa Paula are *A. Antiselli*. California botanists and the writer have also confused it with the next.

70. *Astragalus capillipes* n. sp. Pods about 2.5 cm. long and 1 cm. high, about 3 mm. wide, greatly laterally flattened, half oval, the ventral suture a little convex toward the tip, apiculate. Flowers 1.2 cm. long, white, not stubby, in spikes. Banner oblong, about 1 cm. long, but rather variable, rather abruptly erect remote from the calyx, with sides reflexed above, about 4 mm. longer than wings. Wings broadly linear, about 1 mm. longer than keel. Keel straight and tip triangular and erect and rather narrow, obtuse. Calyx about 2 mm. long and wide, very oblique at both ends, truncate at base, teeth minute and deltoid one-third to one-fourth as long as tube. Pedicels about as long as calyx and longer than the bracts. Peduncles many, axillary, about 1 dm. long, with pods racemose and rachis about 5 cm. long. Stems erect, 2-3 ft. high, nearly simple. Stipules small, triangular and green. Leaves about 1 dm. long, about sessile, with 15-20 pairs of narrowly elliptical leaflets about 1 cm. long, obtuse or notched, nearly contiguous, very minutely pubescent with short and fine appressed hairs. The type is material from Blanche Trask Catalina Island, also material from the island from Brandegee. I refer here also No. 1338 Orcutt from San Telmo Lower California, with some doubt. The character of stubbiness in a flower for the most part is a valid one as opposed to a narrow flower with long banner, but falls down in *A. procerus*, and may fail in the separation of *Crotalariae* from *vestitus*, and *leucopsis* from what has been called *leucophyllus*, just as the characters of woolliness and silkiness may fail in the same groups, but must be maintained till clearly proven to intergrade. Should this distinction fail this species will then be *A. trichopodus* var. *capillipes*.

71. *Astragalus leucophyllus* T. & G. Fl 1 336 (1838). *Phaca leucophylla* (T. & G.) Hooker & Arnot, not *A. leucophyllus* Willd. (1800) which is a synonym of *A. angustifolius* Lam. (1783). *A. asymmetricus* Sheldon, *A. leucopsis* var. *asymmetricus* (Sheldon) and var. *leucophyllus* (T. & G.) Jones. Pods a little more than half-oval, the ventral suture being a little convex in the middle, about 3 cm. long, on a hoary stipe as long as pod, tip and base deltoid or barely pointed, inclined to be a little obcompressed, pendent. Flowers 1 cm. long, many, ascending. Banner nearly round to oval, about 5 mm. long, gently arched from calyx tips to 45 degrees, with sides reflexed about 1 mm. wide in the middle, barely 1 mm. longer than wings. Wings half-elliptical, veiny, obtuse, about 2 mm. wide, about as long as keel. Keel about 4 mm. long and 2 mm. high, the base a little arched and then rounded to erect and tip cut off nearly square, about 3 mm. high at tip, not colored. Calyx tube oblong-campanulate, about 5 mm. long and 3 mm. high, not oblique below and barely so above, nearly equally inserted on the thick pedicels at the fleshy base, cleft deeper above, teeth subulate from a deltoid base, about half as long as tube. Fruiting pedicels about 4 mm. long, as long as the lanceolate hyaline bracts which are conspicuous. Peduncles about 1 dm. long and half as long as fruiting rachis. Leaves 6-8 cm. long, not narrow, nearly sessile, rigid, with stout and channeled rachis. Leaflets thick, nearly linear, about 2 cm. long, rounded, or acutish, nearly contiguous, 14-18 pairs. Stipules rather falcate triangular, 5-8 mm. long, rigid, erect.

not connate. Stems rather stout and sulcate, 2-3 ft. high, with internodes rarely 3 cm. long, flexuous, from a woody base. Pubescence variably hoary. Lower Sacramento and San Joaquin valleys and over to Monterey and San Luis Obispo. Not often collected.

72. *Astragalus curtipes* Gray Proc. Cal. Acad. 3 103 (1868). *A. leucopsis* var. *curtipes* Jones. *Tragacantha* Kuntze. Pods half-ovate, 3-4 cm. long and 2 cm. wide, sulcate ventrally, sharply triangular-acute, truncate at base or very abruptly contracted into a stipe as long as calyx and set at right angles to it, nearly erect, translucent and very thin and greatly inflated, rather few on a short rachis. Flowers white, with exerted claws, in a short spike 2-4 cm. long, soon reflexed but calyx ascending in fruit. Banner broadly elliptical, 7-8 mm. long, arched remotely from calyx to 45 degrees, with sides reflexed about 1 mm. wide in the middle, about 2 mm. longer than wings, not very fleshy. Wings broadly linear, obtuse, arched a little, veiny, about 1 mm. longer than keel. Keel arched from base to about a half circle, very obtuse, about 4 mm. high and long. Calyx tube campanulate, 4 mm. long and 3 mm. high, rather truncate at base and inserted near the lower corner, cleft deeper above and oblique, the triangular nigrescent teeth a little unequal and a little over half as long as tube. Pedicels stout, about as long as the ovate to lanceolate bracts, 2 mm. long. Peduncles 1-2 dm. long, 3-4 times as long as fruiting rachis. Leaves slender, and not rigid, 6-10 cm. long, narrow, with slender rachis, and petioles even the upper 2 cm. long. Leaflets broadly linear, not thick, 1-1.5 cm. long, rounded, not contiguous, about 15 pairs. Internodes rarely 3 cm. long. Stems rather slender, erect or ascending from a woody base, often with very short internodes and leaves congested later in the season, 1-2 ft. high. Stipules conspicuous, hyaline, connate throughout, often 1 cm. long. Pubescence very minute and ashy. San Luis Obispo California. This has been much confused. It is described by Gray as having pendulous pods, but this seems to be due to the reversal of the pods which sometimes occurs in pressing. The leaflets are described as retuse and 13-33, they are seldom notched and the pairs are many. Most of the material referred to this belongs with *leucopsis*.

73. *Astragalus leucopsis* T. & G. Fl. 1 694 (1840) as *Phaca* and Torr. Mex. Bound. 56 t. 16 (1859). *Phaca canescens* Nutt., *Tragacantha* Kuntze. Pods oblately half-oval and very obtuse at both ends, merely apiculate and about 2.5 cm. long and 1.5 cm. wide in the type, with the ventral suture somewhat arched and sulcate, papery and translucent, abruptly rounded to the stipe which is about 1 cm. long, cross section seemingly about round but a little flattened above, but really triangular-obcordate when fresh, about pendent. Flowers 1-1.5 cm. long, rather thick and in the type stubby with the banner but little longer than the wings, and ascending about 45 degrees to 90 degrees remote from calyx tips, greenish cream-colored, loosely spicate. Banner broadly ovate, with sides reflexed above and 6-8 mm. long, petals with claws inclined to be exerted. Wings narrowly obtuse, nearly straight, close pressed to keel and then flaring above, arched a little, about 2 mm. wide and 2 mm. longer than keel, less, half-oblancheolate. Keel about 5 mm. long, with rather convex base and then abruptly rounded to erect, the tip triangular, obtuse and about 3 mm. high. Calyx hyaline, inserted on the lower corner and rather truncate but not oblique when fresh, a little narrowed at mouth and cleft deeper above, a little laterally flattened, about 3 mm. long and nearly as high, teeth subulate, unequal and little longer than half the tube. Pedicels stout, about 2 mm. long and as long as the triangular-subulate greenish bracts with reflexed tips. Peduncles strict, often a foot long, sulcate, rather long, nearly sessile, with slender rachis. Leaflets elliptical, mostly notched, flat and rather thin, long-petiolulate and cuneate at base,

12-15 pairs, nearly contiguous, about 1 cm. long, obtuse. Stems 2-3 ft. high, woody below and trunk often an inch in diameter. Internodes short and leaves many, erect. Stipules rigid, reflexed, green, rarely 5 mm. long. Common throughout southern California and possibly in the upper San Joaquin valley, also extending on the islands along the coast, to Ensenada Mexico, reaching up into the Lower Temperate life zone on Cajon Pass. *A. leucopsis* var. *brachypus* (var. *curtus* Sheldon) Greene is a form of this with stipe not longer than calyx.

***Astragalus leucopsis* var. *lonchus* n. var.** This is a slender form with pods half-elliptical, about 3 cm. long and 1 cm. high on a stipe fully 1 cm. long or more. Flowers about 2 cm. long, with elongated banner and wings, the banner, 4-6 mm. longer than keel and 3-4 mm. longer than wings, often purple-tinged, and keel purple-tipped. Flowers in heads on the ends of long peduncles. This is my No. 3083 from San Diego. My no. 3675 distributed as *A. curtipes* is an intergrading form. Common with the type. A shrub with stems often an inch in diameter.

***Astragalus leucopsis* var. *fastidius* (Kell.) Jones** Cont. 10 62 (1902). *Phaca fastidia* Kell. Hesperian 4 145 (1860). *A. fastidius* (Kell.) Jones, *A. fastidiosus* Greene. Pods half-oblong-ovate, about 3 cm. long and 1-1.2 cm. high, acuminate with an upturned tip, and deltoid to truncate at base and with stipe hardly longer than calyx. Flowers few and racemose. Stems white-hoary, leaflets nearly smooth above. Islands off the coast of Lower California.

74. ***Astragalus luteus* Jones** Cont. 13 8 (1910). Pods much inflated, 2.5-3 cm. long and about 1.5 cm. high and wide, papery and translucent, lying flat on the ground, reddish, not mottled, oblong-oval to ovate-oval, obliquely triangular-acute at tip and a little narrowed below; the tip inclined to turn up and the base down, sulcate at both sutures but mostly along the ventral which is intruded 2 mm. deep, cross section triangular-reniform to round-reniform, jointed to a stipe shorter than the calyx. Flowers few, white, in a head which is nearly sessile in the axils. Banner white, 1 cm. long, arched abruptly to 45 to 80 degrees 4 mm. beyond calyx tips, thin, with sides reflexed most below and 2 mm. wide, not at all at tip and the banner appears fiddle-shaped, groove very deep and V-shaped, little if at all narrower or flattened at tip, notched deep, about 2 mm. longer than wings and 3 mm. longer than keel. Wings oblong-linear, about 7 mm. long and 2 mm. wide, arched to 30 degrees in a gentle arc, a trifle wider above and oblique at tip, notched on the lower side at tip, rounded, white, faintly purple-veined below, folding over the keel tip. Keel 2 mm. long and 2 mm. high, very flat, lunate, the triangular tip and base about equal purple. Calyx hyaline, reddish, cylindrical, much laterally flattened, the tube about 7 mm. long and 3 mm. high, with straight base and upper side arched, not oblique below, equally inserted, mouth a trifle contracted and a little oblique, notched deeper above, nigrescent. Teeth triangular, about 1-2 mm. long. Pedicels stout about 2 mm. long, as long as the triangular bracts. Fruiting peduncles about 2.5 cm. long, with 1-4 pods. Leaves when fully developed about 7 cm. long, broad, with slender petioles nearly as long as rachis. Leaflets about 12 pairs, mostly folded, oval, about 7 mm. long, rounded, shortly-petiole, with fine and dense appressed hairs, hoary. Stems almost filiform, about 1 dm. long, almost wholly underground, with 1-3 nodes above ground, with large oval to oblate stipules not connate and about 4-5 mm. long. Stems several to many from the crown of a large, thick fleshy erect root. Growing in the poorest white shale on bare places at the foot of cliffs but not in loose debris, and on ridges. Lower Temperate life zone on the White river western Colorado north of Dragon. In fruit in May, blooming very early.

75. ***Astragalus megacarpus* (Nutt.) Gray** Proc. Am. Acad. 6 215 (1864). *Phaca megacarpa* Nutt. in T. & G. Fl. 1 343 (1838). Pods nearly 6 cm.

long, oblong-oval to oblong-ovate, sulcate ventrally and a little oblique, prow-like tipped, rather truncate at the somewhat narrowed or abruptly rounded base, round to oval-reniform in cross section, with stipe 2-7 mm. long but shorter than calyx. Ventral suture a mere sharp-edged line externally. Flowers 2.5 cm. long, white, thin. Banner narrowly-oval, about 1 cm. long nearly flat, arched abruptly to 80 degrees or erect at the end of calyx tube or teeth and with very broad groove. Wings linear, nearly straight, rounded, about 1-2 mm. wide and 3-4 mm. shorter than the banner, and nearly as much longer than keel, concave to keel and flaring. White spot of banner triangular and with obscure purple veins going nearly to the upper third of banner. Keel about 3 mm. long and high, but little surpassing calyx, arched to a half circle from base, the tip triangular and obtuse and a little darker colored. Calyx tube cylindrical, nigrescent with scattered and very short hairs, about 1 cm. long and 3-4 mm. high, a little flattened laterally, narrowed a little at tip and deeper cleft with a sharp sinus, the upper side a little convex in the middle with the base straight, deltoid and fleshy and attached just below the middle of the end, teeth narrowly triangular and about half as long as tube. Pedicels 5-8 mm. long, mostly bracteate, several times as long as the ovate to triangular bracts. Peduncles almost none in flower, about 5-8 cm. long in fruit, filiform, with a few ascending and racemose flowers close together near the end. Leaves 1-1.5 dm. long, narrow. Petioles nearly half the whole and persisting for several years at the crown. Leaflets thin, oval to elliptical and tending to ovate and notched, about 1 cm. long, shortly cuneate and petiolulate. Stems prostrate in small tufts, many, only a few inches long, from a stout and long fleshy root. Stipules inclined to be imbricated, triangular, hyaline, very broad below and short, not over 5 mm. long. This grows in the bad lands of Wyoming north of the Uintas to Sapinero Colorado around the edges of the Navajo Basin in the Lower Temperate life zone on the poorest of clay soil in little gulches mostly, and on sharp slopes where there is a little alkali. It blooms very early in the spring, and the enormous pods (the largest in the genus) which are wholly out of proportion to the size of the plants soon blow off and lodge in the surrounding tufts of grass or weeds. It is a very variable species.

Astragalus megacarpus var. **Parryi** Gray Bot. Cal. 1 148 (1876). *A. megacarpus* var. *prodigus* Sheldon. This differs in no particular from the species except that the flowers are 1.5 cm. long and purple-tipped with banner beautifully purple-veined, wings linear-oblongate and about 2 mm. wide and keel base straight and purple-tipped. Calyx tube 5-6 mm. long, rather narrowed below and teeth often only a third the tube and triangular. The pubescence varies from none to densely hoary with rough and very short and appressed hairs on the younger parts. Leaflets about 5 mm. long and round to oblong, notched to apiculate. Pods generally smaller. Theodore, Gunnison, Vermilion, Sevier Bridge, Cedar City, Elk Ranch on the upper Virgin Utah. Lemmon, Rusby and Toumey also collected it in northern Arizona around the San Francisco peaks. This grows under oak brush near Tropic, but in other places in draws of the barren clay slopes of the Tertiary clay strata, locally abundant, but rare generally. Rusby's flowers are yellow when dry.

76 **Astragalus oophorus** Watson Bot. King 73 (1871). *A. artipes* Gray, Phaca Rydberg. Pods obliquely oval-ovate, about 3 cm. long and 2 cm. wide and nearly as high, papery to nearly coriaceous, either flattish on the ventral suture or somewhat sulcate, the suture straight or a little convex, apiculate, deltoid to triangular-tipped, either truncate or deltoid at base, drooping, cross section cordate-obovate, ventral suture raised as a thin wing 2 mm. high or varying to a sharp edge only, inclined to be upcurved, pod often boat-shaped and then a little laterally flattened, jointed to stipe at base or somewhat produced

into a stipe which is jointed and then produced as a stipe which is about as long as calyx, the whole stipe as long as or twice as long as calyx tube. Flowers in the type cream-colored almost exactly as in *A. Beckwithii*, shortly racemose, about 10, ascending, about 1.5 cm. long, rather wide. Banner oval to broadly oblong, arched abruptly to 45 to 90 degrees, remote from calyx tips, nearly 1 cm. long, with sides reflexed in the middle and so appearing fiddle-shaped, the erect part a little humped near the middle by the half-conical sulcus. Wings 2-3 mm. shorter than banner and nearly as much longer than keel, about 2 mm. wide and linear. Keel with exserted claw, about 3 mm. long and high, very obtuse and arched to a half circle, barely darker tipped. Calyx tube campanulate, about 4 mm. long and high, nearly equally inserted at the rounded and slightly oblique and fleshy base, cleft a little deeper above with a broad sinus but hardly oblique, all the sinuses rounded, and teeth filiform and as long as tube. Pedicels 3-4 mm. long, nearly as long as the lanceolate and hyaline bracts. Leaves about 1 dm. long, narrow and rather rigid, with petiole decidedly shorter than the rachis. Leaflets 4-12 pairs, from round to oblong-elliptical, always with cuneate base, 1-2 cm. long, smooth and leathery, glaucous. Stipules triangular-falcate, rather rigid and spreading, not over 5 mm. long. Stems slender, in tufts, rarely a foot long, flexuous, with congested lower nodes, leafy, the upper internodes rarely 3 cm. long, ascending or the central ones erect, from an erect, slender, fleshy root. Common on gravelly slopes in desert regions from Gunnison Colorado to the Sierras, northward through Utah Valley Utah and the Reese river Nevada, southward to the Mogollon plateau Arizona and the Charleston Mts. and Death Valley. Lower Temperate life zone. This and *A. Beckwithii* inhabit the same regions but do not grow together nor seem to hybridize. The southern forms are mostly the var. *artipes*. Bailey's specimen mentioned in Coville's Death Valley Rep. is *A. megacarpus*.

Astragalus oophorus* var. *caulescens (Jones Cont. 7 643 (1895) (1878) as species). This has purple banner and keel and white wings, calyx teeth triangular and about half as long as tube, tube often 7 mm. long and 4 mm. high, pods inclined to be acuminate into the stipe, papery and much mottled. This is the common form of the southern range.

Astragalus oophorus* var. *caulescens (Jones Cont. 7 643 (1895) as *megacarpus* var.) This is a form with nearly coriaceous pods acuminate at both ends, barely mottled, and calyx teeth as long as tube, and which begins to approach *A. Beckwithii*, Weber Quarry, Loa, Loa Pass Utah. Glenwood Springs, Colorado.

77. ***Astragalus Beckwithii*** T. & G. Pac. R. R. Rep. 2 pt 2 120 t. 3 (1855). Pods oblong and obliquely acuminate, 2.5-4 cm. long, 7-10 mm. wide, cross section Y-shaped by being bisulcate ventrally and the suture raised as a sharp and strong rib, concavely triquetrous mostly, rather reniform in the var. *Weiserensis*, a little fleshy when fresh, transversely rugulose or smoothish, dorsal side a little convex or flat or a trifle sulcate, in the type not pulpy within when fresh, often minutely and sparsely black-hairy, with stipe about as long as calyx and then jointed to the tapering and stipe-like base of pod. Flowers crowded in short racemes. cream-colored in the type, about 1.5-2 cm. long, 6-10. Banner abruptly arched about 4 mm. beyond calyx tips and opposite the end of keel to erect, oblong, deeply notched, with sides reflexed only in the middle, and fiddle-shaped, waterlined; groove broadly V-shaped above, a half circle below and making the lower part of banner very convex externally and club-shaped above the juncture with the fleshy claw, the blade about 12 mm. long and 1 mm. wide. Wings obliquely oblanceolate, narrowed and nearly acute at tip, 3-4 mm. wide, about 7 mm. longer than keel. Keel faintly purple-

veined, 3-4 mm. long and high, arched into about a half circle, on a rather long-exserted claw. Calyx oblong-campanulate, 4-7 mm. long, nigrescent, the triangular-subulate teeth about as long as tube but variable. Pedicels 2-4 mm. long with bracts ovate to lanceolate 2-5 mm. long and hyaline. Peduncles 5-15 cm. long, rarely as long as leaves, stout. Leaves with variable petioles but never as long as rachis, 1-2 dm. long, the rachis and peduncles coarsely sulcate. Leaflets 6-12 pairs, round to rather broadly elliptical, shortly petiolulate, veinless, rounded to notched, 2-15 mm. long. Stipules ovate to triangular-subulate, not connate, spreading and rather stiff, rarely 5 mm. long. Stems tufted from a branched and woody root, ascending, branched below, a few inches to 2 ft. high, the pods about pendent on the nearly horizontal peduncles. Growing on gravelly slopes and flats in rather poor soil. From western Wyoming on the bad lands and the western base of the Wasatch through San Pete and Sevier Valley to Cedar City and Pioche Nevada and northward to the Tukenon river Washington and Spence's Bridge B. C. and the Snake River valley and Lewiston, Idaho, more common at the north. Lower Temperate life zone.

Astragalus Beckwithii var. purpureus Jones Cont. 3 288 (1893). *A. artemisiarum* Jones. Pods filled with pulp when young and becoming very rigid when ripe. Flowers with purple banner and keel and bases of wings, white spot purple-veined. Wings obliquely ovate. Leaflets inclined to be diamond-shaped, not over 1.2 cm. long, about 1 cm. wide. This is the common form in eastern Nevada.

Astragalus Beckwithii var. Weiserensis Jones Cont. 9 47 (1900). Pods little mottled, coriaceous, about 4 mm. high, 1 cm. wide and 2.5 cm. long, arcuate to about one third circle, pungently acute, oblong-elliptical, ventral suture raised as a wing 1 mm. high. Flowers few, racemose to almost capitate, about 2-2.5 cm. long, not colored, thick. Banner abruptly arched at calyx tips, about 4 mm. longer than wings. Wings boardly linear to elliptical-oblongate 3-4 mm. wide, 3-4 mm. longer than keel, almost acute. Calyx tube about 4 mm. long and high, with the narrowly-linear teeth as long as tube as in *A. megacarpus*. Bracts about 1 cm. long, two to three times as long as the pedicels. Peduncles about half as long as the leaves. Leaves about 2 dm. long, with 6-8 pairs of elliptical to obcordate leaflets, mostly 2 cm. long. Stipules very large, deltoid, 1 cm. long. Stems rather stout a foot long, decumbent. Growing under the sagebrush at Weiser Idaho, on the edge of the Lower Temperate life zone. This has many of the characteristics of *A. megacarpus* as to flowers and general habit. Though there are certain marked differences in pods the remarkable similarity in flowers and general habit shows that all the species of this group are intimately related. Watson's No. 271 is a mixture of material, that from the Coyote Mts. Nevada is this variety in all probability.

78. **Astragalus triquetrus** Gray Proc. Am. Acad. 13 367 (1878). *A. Geyeri* var. *triquetrus* (Gray) Jones. Pods somewhat arcuate-oblong, deltoid-acute at tip, and obtuse but somewhat narrowed at base, about 6 mm. high and 3 mm. wide, deeply sulcate dorsally, and with suture slightly produced below the middle, with flat sides, the ventral suture a little concave and a mere line, the tip flat, finely nerved and smooth. Flowers minute, white, those of *A. Geyeri*. Peduncles axillary, very slender and much shorter than the leaves. Leaves 3-5 cm. long, short-petioled, many, divaricate. Leaflets about 4 pairs, elliptical, 5-8 mm. long. Stems flexuous, 1-2 dm. long, freely branched, spreading from a slender annual root. Internodes 1-3 cm. long. Pubescence ashy. Sandy deserts of southeastern Nevada. Tropical.

79. *Astragalus Craigi* Jones Cont. 9 42 (1900). Pods a little arched nearly 2 cm. long, about 6 mm. wide and high, triangular-acute at both ends, the tip a little upturned and flat, the base straight, when young laterally flattened but when mature decidedly inflated and translucent, the cross section nearly oval-reniform, slightly to deeply sulcate dorsally and suture produced as a thin edge but hardly one half mm. high, nearly smooth. Flowers white about 7 mm. long, arched. Banner purple-veined, about 4 mm. long, oval, abruptly arched to erect at calyx tips, with sides reflexed 1 mm. wide. Wings oblong, ascending, 2 mm. longer than keel. Keel a little exceeding the calyx, rounded and obtuse, short, incurved with erect and straight tip. Calyx tube campanulate, 2 mm. long, and oblique, narrowed, slender, 2 mm. long. Bracts minute, triangular. Peduncles axillary, 1-3 cm. long and as long as the floral rachis, 6-8 flowered, sulcate. Leaves about 7 cm. long. Leaflets 4-5 pairs, obovate, long-petiolulate, inclined to be a little alternate below notched, thickish, 7-10 mm. long. Stems perennial and widely spreading, branched, with internodes 2-3 cm. long, about a foot long. Stipules small, green, not connate. Pubescence almost none, hairs short and appressed. John Day river Oregon, May 1885, Howell. Named for Prof. Craig in whose herbarium it was found. Middle Temperate life zone.

80. *Astragalus lentiginosus* Douglas in Hook. Fl. Bor. Am. 1 151 (1834) *Cystium* Rydberg. Pods oblique, with oblique and mostly upcurved tips, sulcate at both sutures, often didymous. Flowers with large keel. This is the most variable of all *Astragali*. It ranges from the Middle Temperate peaks to the Tropical deserts. The varieties are best arranged under the following key.

Flowers in heads. Clearly perennial.

Pods in heads.

Pods translucent or papery.

Stems prostrate or much elongated. Flowers narrow, not over 1 cm. long, white or purple-tinged. Peduncles shorter than the leaves.

Pods long-pointed, from ovate and hooked to linear. Leaflets obovate.

A. lentiginosus and *Var. diaphanus*.

Pods very short-pointed, globose or nearly so, little over 1 cm. long.

Vars. ineptus, albifolius and Sierræ.

Stems ascending to erect.

Vars. MacDougali and nigricalycis.

Pods chartaceous or coriaceous, not translucent.

Pods narrow and much arched or hooked, but little inflated, small.

Vars. scorpionis, Idriensis and carinatus.

Pods large, ovate to oval.

Vars. diphysus and latus.

Pods in spikes.

Var. palans.

Flowers and pods in racemes or at least not heads. Plants inclined to be biennial and blooming as winter annuals. Mostly Tropical.

Pods in long racemes, lanceolate, acuminate, incompletely 2-celled, the dorsal suture not being fully intruded along the middle and not at all at tip, but little inflated.

Vars. Mokiensis and Borreganus.

Pods broadly ovate and large, much inflated and mottled. Racemes short.

Banner and wings longer than keel. Stems flexuous and widely spreading. Leaflets inclined to be obovate and silvery-pubescent.

Vars. Coulteri, Fremonti and Yuccanus.

Astragalus lentiginosus typical. Pods ovate and acuminate with up-turned flat beak, about 2 cm. long, 1 cm. wide, often mottled, with cross section about round. Leaflets nearly smooth, about 8 pairs. Peduncles in most of the axils and very short. Leaves 5-10 cm. long, narrow. Occasional in the Columbia Basin in the valleys. Middle and Lower Temperate life zones.

Astragalus lentiginosus var. *diaphanus* (Dougl.) Jones Cont. 7 675 (1895). *A. diaphanus* Dougl. in Hook. Fl. Bor. Am. 1 151 (1834).

Pods linear and laterally compressed, about 2 cm. long, incurved, translucent and very thin. Lower Columbia Basin, Lower Temperate life zone. Seldom collected.

Astragalus lentiginosus var. ineptus (Gray Proc. Am. Acad. 6 525 (1865) as species.) Leaflets narrowly to broadly elliptical, Common in the sagebrush valleys along the eastern face of the Sierras from Walker Lake northward. *A. lentiginosus* var. *floribundus* Gray is a form with acuminate pods, and *A. salinus* is a form with broad leaflets and short globose pods, both inter-grading with the type. Forms with broader flowers about 1.5 cm. long and large leaflets and papery pods nearly 2 cm. long from Wyoming and Utah inter-grade freely with the var. *diphysus*. Lower Temperate life zone, in rather alkaline places.

Astragalus lentiginosus var. albifolius n. var. This is a form with filiform peduncles 5-6 cm. long, little white flowers about 8 mm. long, broad sessile leaves about 8 cm. long, pods oval-ovate and apiculate, narrowly-elliptical, long-petiolulate, silvery-white leaflets about 1.5 cm. long, with closely appressed pubescence of short white hairs, and stems 2-3 ft. long. Internodes long. It is a remarkable variation. Lone Pine Owen's Valley California in alkaline meadows. Lower Temperate life zone.

Astragalus lentiginosus var. Sierræ n. var. Pods mottled, single to few 1.2-1.5 cm. long and almost sessile in the axils on very short and stout peduncles, leaves all petioled, about 3 cm. long, with about 8 pairs of oblong-obovate thick and smooth leaflets closely touching, and with short internodes. Stems about a foot long. Root thick and woody. In gravelly soil Bear Valley California. Middle Temperate life zone, in open spaces.

Astragalus lentiginosus var. MacDougali (Sheldon) Jones Cont. 7 673 (1895). *A. McDougali* Sheldon Minn. Stud. 9 169 (1894). Pods densely clustered, many, globose, about 7-10 mm. long and wide, very abruptly and obliquely flat tipped, on subterminal stout peduncles nearly as long as leaves. Leaves 5-7 cm. long, with nearly 10 pairs of smooth oval to elliptical leaflets about 1 cm. long. Stems about erect, a foot high, branched below. San Francisco Mts. Arizona. Middle Temperate life zone.

Astragalus lentiginosus var. nigricalycis Jones Cont. 7 674 (1895.) Pods few at the ends of peduncles about as long as leaves, smoothish and mottled when mature, oval-ovate, with very short and deltoid oblique tip, about 2 cm. long and 1.5 cm. wide, greatly inflated. Flowers about 1.2 cm. long. Calyx black-hairy, teeth a fourth as long as tube. Leaves about sessile, 5-7 cm. long. Leaflets 8-10 pairs, oblanceolate, 1.5 cm. long. Stems ascending, a foot or two long. Whole plant softly and rather sparsely woolly. Bakersfield and Alameda California in open flats. Tropical.

Astragalus lentiginosus var. scorpionis n. var. Pods coriaceous, ovate, abruptly hooked and claw-like, hardly 1 cm. long. Flowers about 8 mm. long with elongated banner and wings, calyx campanulate, leaflets small, oval to elliptical. Peduncles half as long as leaves. Morey Peak Nevada No. 6365 Purpus, and Brandegee from the Yakima region Washington 1883, and No. 896 McBride from Emmett Idaho. Middle Temperate life zone. Flowers white or purple.

Astragalus lentiginosus var. Idriensis Jones Cont. 10 63 (1902). Pods lanceolate, often arched to a circle, about 2 cm. long, when not greatly obcompressed the cross section is triquetrous-cordate, otherwise rather didymous and transversely linear. Flowers purple-tipped, about 1.5 cm. long and very narrow, the wings and banner elongated, and the keel normal that is half-spatulate and the blade about 3 times as long as wide. Calyx cylindric and about 5 mm. long and 2

mm. wide, the teeth about one fourth as long as tube. Peduncles about 6 cm. long and twice as long as the sessile and divaricate leaves which have about 10 pairs of obovate leaflets about 1 cm. long, thick, appearing as if glaucous, smooth above and ciliate and a little appressed hairy below. Stems very slender and widely spreading with long internodes and from a woody root. New Idria California, Miss Eastwood.

Astragalus lentiginosus var. carinatus n. var. Pods as in the var. *Idriensis* but not often mottled, often long-acuminate. Flowers white with purple-tipped keel. Banner oblong, from half as long to nearly as long as keel, abruptly arched to 45 degrees at calyx tips. Wings linear, straight, about 1 mm. shorter than keel. Keel conspicuous, half-spatulate, about 5 mm. long. Calyx campanulate, the tube about 2 mm. long and a little longer than the rather spreading teeth. Peduncles filiform 2-3 cm. long, about a half shorter than the leaves. Leaves ascending, all petioled, with about 8 pairs of elliptical leaflets which are about 5 mm. long, appearing as if glaucous, and ciliate and slightly pubescent beneath as in the preceding variety, but thin. Stems several, equally slender and prostrate or nearly so from a slender or rather thick and woody and erect root. Baker City Oregon on flats, June 11, 1902, and Chat, California. Middle Temperate life zone.

Astragalus lentiginosus var. diphysus (Gray) Jones Cont. 7 673 (1895). *A. diphysus* Gray. Pl. Fend. 35 (1849). var. *chartaceus* Jones. Pods ovate and with falcate and variously acuminate tip, or body oval but always with the falcate beak, cross section variously reniform to didymous, often 4 cm. long. Leaves all petioled, leaflets mostly obovate, rarely elliptical, 8-10 pairs, 1-2 cm. long, mostly smooth. Peduncles shorter than the leaves which are often 1 dm. long. Internodes short. Stems many in tufts, erect to ascending, a foot or two high. Flowers about 2 cm. long, purple, with elongated banner, the oblanceolate wings rather longer than keel. Common in the sagebrush from Santa Fe New Mexico and Holbrook Arizona to Wyoming, southern Idaho and the Sierras. This intergrades freely into the forms with papery pods. *A. cuspidocarpus* Sheldon which is *A. ammolutus* Greene, as to Leiberg's material at least is a form of this. Middle and Lower Temperate life zones. A form of this from Lima Montana intergrades with the type species. *A. lentiginosus* var. *chartaceus* Jones is a form intergrading with the var. *latus* below.

Astragalus lentiginosus var. latus. (*A. diphysus* var. *latus* Jones Cont. 3 287 (1893). *A. latus* Jones Cont. 5 272 1894) also. This is a densely caespitose form with woody stems from a stout root and herbaceous tips a few inches long and flat on the ground. The pods are almost globose and conical pointed, varying to oval with rather falcate tip, about 2 cm. long, didymous, often mottled, hidden among the leaves on peduncles rarely over 2 cm. long. Flowers light-purple, about 2 cm. long, very narrow, the banner and wings elongated. The tubular tube is about 8 mm. long and 3 mm. wide, and the teeth triangular to filiform and often half as long as tube. Leaves about 1 dm. long, all petioled, with about 6-8 pairs of oval to obovate leaflets, a little over 1 cm. long and smooth. A remarkable variety but nothing else. Rocky canons in the mountains free from alkali. Middle Temperate life zone. Rather common in eastern Nevada. Type locality Aurum. A form of this with tiny flowers and globose and apiculate pods rather papery is from Monatchy Meadows California Purpus, No. 1971, and is ashy pubescent.

Astragalus lentiginosus var. palans Jones Cont. 4 37 (1893) and Cont. 8 4 (1898). Pods linear and falcate often to a half circle, 3-4 cm. long and hardly 5 mm. wide, with cross section inclined to be triquetrous, sharply acuminate, cross-wrinkled. Flowers purple and about 2 cm. long with elongated banner and wings and cylindrical

tube and filiform teeth. Peduncles rarely half as long as leaves. Leaves often 1 dm. long, widely spreading, with about 8 pairs of oval to elliptical leaflets 1-2 cm. long, mostly notched and smooth. Stems normally elongated and straggling over the ground. Growing in rather alkaline soil along the tributaries of the Colorado river from the San Juan to Grand Junction Colorado and westward to Virgin City, Utah. Southward at least to Flagstaff Arizona. This is the common form of the species in the Navajo Basin. Lower Temperate life zone. *A. araneosus* Sheldon from Frisco Utah (Jones) is a form intergrading with the var. *diphysus*. It also occurs at Detroit Utah and Austin Nevada.

Astragalus lentiginosus* var. *Mokiacensis (Gray Proc. Am. Acad. 13 367 (1878) as species). *A. ursinus* Gray. *A. Wilsoni* Greene. Pods smooth, a little cross-wrinkled, 1.5-2 cm. long and about 5 mm. wide, with cross section round and inclined to be sulcate ventrally and a little dorsally but shallow, almost straight to a little bent in the middle, only slightly oblique, ascending, coriaceous, with dorsal suture intruded hardly half way below, the pods vary from ovate-lanceolate to linear lanceolate. Flowers bright pink-purple as in *A. Utahensis*, bluish when dry, horizontal to little ascending, about 2 cm. long, not narrow. Banner oblong-oval, about 1.2 cm. long, abruptly arched to nearly erect at calyx tips, with sides reflexed 4 mm. wide below, little above; groove shallow and very broadly V-shaped throughout; white spot obovate, barely reaching tip of keel, striate-purple-veined, narrow and small, about 3 mm. wide and 4 mm. long, not reaching within 5 mm. of banner tip and is barely wider than the reflexed part on each side. Wings 2 mm. wide, straight, concave to keel and pressed close, about 1 mm. longer, rounded. Keel half-spatulate, about 3-4 mm. wide at tip, straight, 7 mm. shorter than banner. Calyx tube about 5 mm. long and 3 mm. high, cylindrical-campanulate, greenish or reddish, oblique, sparsely nigrescent, cleft deeper above with rounded sinuses, somewhat laterally flattened, attached near the middle at the fleshy base to the stout pedicel, teeth subulate and about 2 mm. long, the lower the longer. Pedicels about half as long as the lanceolate and hyaline bracts which are about 3 mm. long. Peduncles stout, subterminal and strict, 5-7 cm. long, sulcate, about half as long as the racemes and about as long as leaves. Leaves nearly sessile above, with 5-7 pairs of oval-ovate, rather notched leaflets about 1 cm. long, which seem glaucous but are whitish with fine wavy appressed hairs, rather sparse. Stems erect, thick, nearly straight, rather fleshy from a woody root. Stipules green, reflexed, about 5 mm. long. Growing on the plateau south of St. George on both sides of the Colorado river. Lower Temperate life zone. This seems like a well marked species but it intergrades through the var. *palans*.

Astragalus lentiginosus* var. *Borreganus Jones Cont. 8 3 (1898). Pods as in the var. *Mokiacensis* but silvery white, in long racemes often a foot long, and suture intruded about two thirds. Peduncles the same as above but axillary nearly throughout and slender in flower. Leaves about the same but all petioled and rarely over 5 cm. long, the leaflets about 5 pairs and obovate mostly and silvery white with very fine and closely appressed hairs. Flower about the same relative shape but hardly 1 cm. long, the keel being oblately half-oval-ovate, and the calyx tube hardly 4 mm. long. Pedicels almost none, 1 mm. long in fruit. Stems slender and flexuous, rarely a foot high and branched. Clearly a winter annual. Tropical in the Colorado desert. Extending as far east as Kelso California east of the Amargosa desert. This shades directly into the var. *Coulteri*.

Astragalus lentiginosus var. Coulteri (Benth.) Jones Cont. 8 4 (1898). *A. Coulteri* Benth. Pl. Hartweg. 307 (1848). *A. Arthu-Schotti* Gray. *A. eremicus* Sheldon. Pods rigid, not leathery nor papery, hoary as is the whole plant, about 2 cm. long, very oblique and falcate-short-pointed. Flowers about 1.5 cm. long, wide, the subulate calyx teeth nearly as long as tube. Leaflets often 2 cm. long. Pubescence greatest on the under side of the leaflets. Common on the Colorado and Mojave deserts, and Owen's Valley California. Tropical. On flat and gentle slopes. Biennial. This is almost certainly a hybrid between *lentiginosus* and *aridus*.

Astragalus lentiginosus var. Fremonti (T. & G.) Watson Bot. King 66 (1871). *A. Fremonti* T. and G. Pac. R. R. Rep. 4 80 (1857). *A. Coulteri* var. *Fremonti* (T. and G.) Jones. Pods translucent and papery and smooth, oval-ovate with a more or less falcate tip, 2-3 cm. long. Flowers about 1 cm. long and narrow, the triangular teeth rarely one third as long as tube. Leaflets rarely 1.5 cm. long, silvery-pubescent above, less pubescent below, often a little woolly. Common from Hawthorne Nevada and Darwin and the Death Valley region to Mexico. Tropical.

Astragalus lentiginosus var. Yuccanus Jones Cont. 8 3 (1898). Pods papery, translucent and smooth, about 2 cm. long, oval-ovate and short-pointed. Peduncles stout and about as long as leaves, about 1 dm. long, in all the upper axils. Flowers white, about 1 cm. long, narrow, banner wings and keel about equal. Calyx teeth minute. Leaves nearly sessile, divaricate, about 1.5 dm. long, with 10-12 pairs of nearly oval leaflets about 1.5 cm. long. Pubescence almost none except a little spreading hairs on stems, peduncles and rachis. Stems very stout, 2-3 ft. high, erect, biennial, blooming as winter annuals. *Yucca* Arizona, Jones. Tropical. Similar material from Good Springs and Meadow Valley Wash Nevada but with elongated banner and wings and calyx teeth subulate and one third as long as tube. Other material similar but with coriaceous pods from Peach Springs and Lee's Ferry Arizona. Lower Temperate life zone, and intergrading toward the var. *Mokiensis*. Other material from Chloride Arizona with the flowers of *Mokiensis* but otherwise the var. *Yuccanus*.

SPARSIFLORI. 5.

Pods chartaceous, reticulated, lunate, sulcate dorsally with ventral suture concave or rarely straight, tip straight or ascending nearly in line with the ventral suture, but which is humped a little at the end, acute at both ends or short-stipitate, not splitting the calyx, cross section normally triquetrous, pod laterally flattened, a little inflated, with tip flat and triangular-acute, length normally 1-3 cm. but sparsiflorus is shorter. Flowers light-colored, mostly capitate, rarely short-racemose, reflexed or widely spreading, 5-10 mm. long, with campanulate calyx tube 1-3 mm. long. Banner oval, arched abruptly at (below only in *A. villosus*) or beyond calyx tips to 45 to 90 degrees, with sides reflexed below, notched, 3-6 mm. long, nearly twice as long as keel. Wings narrowly oblong, obtuse, about 1-2 mm. wide, narrower than keel and arched somewhat. Keel straight below, abruptly arched at tip to erect and tip triangular and 2-3 mm. high and rounded to acutish and dark or colored. Bracts small, or narrow. Pedicels slender. Peduncles longer than the leaves except in typical sparsiflorus when fully mature, axillary nearly throughout, slender. Middle leaves 5-12 cm. long, about three times the internodes, the lowest leaves very much reduced. Petioles short above, leaf rachis long and filiform. Leaflets rather long-petiolulate, flat, rather distant, narrowly-elliptical to obovate, rounded to retuse, not over 1 cm. long, 4-12 pairs. Stipules 2-4 mm. long except in *villosus*, greenish. Stems filiform or nearly so and prostrate or straggling, 2-7 dm. long, forming mostly open mats from a single crown terminating an erect and slender root. Plants perennial. Pubescence attached by the base and often loose.

KEY

A. prostrate plants. Pods reticulated, chartaceous, ascending, wider above, with cross-section triangular-cordate and with dorsal suture a mere line within, and the ventral suture not intruded but merely a sharp and raised line. Calyx teeth as long as the tube. Leaflets oval to obovate. Flowers reflexed in oblong spikes. Leaves nearly sessile.

Pubescence of soft, long, spreading hairs.

81 villosus.

Pubescence none except on calyx.

82 obovatus.

2A. Plants weak and decumbent. Calyx teeth short. Flowers rather few. Leaflets mostly narrow. Leaves all petioled. Pods chartaceous, mottled, with dorsal suture little intruded or not at all, wider above, cross section ovate to triangular-cordate. Flowers very few, hardly 5 mm. long, much arched, and rather scattered, on peduncles shorter than the leaves.

83 sparsiflorus

81. *Astragalus villosus* Mx. Fl. 2 67 (1807), *A. intonsus* Sheldon, *Phaca villosa* (Mx.) Nutt. Pods about 2 cm. long, acuminate at both ends, narrowly lunate, appearing as if lanceolate but not larger below, about 3 mm. high in the middle, rather deeply sulcate dorsally. Flowers about 1 cm. long, in oblong heads, rather many, white or cream-colored. Banner about 6 mm. long, strongly arched near the end of the tube to nearly erect, about 4 mm. longer than keel and 2-3 mm. longer than wings. Wings about 1 mm. wide, conspicuously arched. Keel about 4 mm. long, barely surpassing the calyx lobes, with the base arched and then abruptly erect to the triangular tip which is acute and slightly turned out and cuspidate. Calyx tube 2-3 mm. long, green, obliquely campanulate, the lower side somewhat narrowed at the pedicel and the upper side inclined to be saccate, but pedicel inserted in the middle of the end; teeth broad with triangular base and subulate above, as long as or nearly twice as long as tube. Bracts lanceolate, green, 2-3 mm. long, longer than the fruiting pedicels. Peduncles about 1 dm. long, the fruiting rachis about 2 cm. long. Stems very weak, with many rather short internodes, hardly a foot long, nearly prostrate, much branched below and from very slender underground stems, the lower internodes with large overlapping stipules which are rather connate behind the petioles but not in front, and adnate, green, 1 cm. long, triangular-acuminate, reflexed. Leaves lax, 1 dm. long or less, with weak and scarcely tapering rachis. Leaflets 6-8 pairs, the terminal one the largest, and gradually smaller below, about oval, rounded, rarely notched, the base not noticeably cuneate, short-petiolate, the largest rarely 8 mm. long, thin. Pubescence, loose, long, of very slender, twisted, blunt, straight hairs, somewhat spreading, and never very dense, the upper side of leaves smooth, the calyx, pods, peduncles and stems shaggy. Dry pine barrens from South Carolina to Florida and westward to Louisiana and Missouri. Lower part of Lower Temperate to the Tropical life zone. Blooms from March to May. I keep up the name of Michaux instead of the *intonsus* of Sheldon for the reason that the *A. villosus* of Gueldenst. It. 2 178 seems to have been only incidentally named.

82. *Astragalus obcordatus* Ell. Sketchb. 2 227 (1822) *A. Elliotti* Dietr., *Tragacantha* Kuntze, *Tium Rydb.* Pods crescent shaped, 2-3 cm. long, about 7 mm. high, acute at both ends, chartaceous, smooth, sulcate nearly to the middle dorsally, very shortly-stipitate, the sides inclined to concave, walls with raised reticulations. Flowers 5-8 mm. long, pale-purple or nearly white, loosely spicate, 5-15. Banner 4-6 mm. long, arched rather abruptly at end of teeth to erect, with reflexed sides 1-2 mm. longer than wings which are about 1 mm. longer than keel and much arched. Keel with straight base and abruptly erect and blunt tip mostly purplish, about 3 mm. long. Calyx rather narrowly campanulate, hyaline, the tube 2 mm. long, rather narrowed below and inserted a little below the middle of the end, sparsely appressed-short-pubescent, teeth narrowly triangular, as long as tube, the lower the longer and arched. Bracts minute, ovate, shorter than the short and filiform pedicels. Peduncles filiform, 5-10 cm. long. Leaves 7-10 cm. long, with filiform rachis. Leaflets obcordate, rarely 6 mm. long, with short-cuneate base, rather long-petiolate, 7-12 pairs, the central ones the largest and tapering both ways on rachis. Stems as in *villosus*, but stipules minute. Whole plant except the calyx smooth. Among scrub oaks and in dry pine barrens Florida to Georgia. Blooming in March and April. Tropical. A very close relative of *A. villosus*.

83. *Astragalus sparsiflorus* Gray Proc. Phil Acad. 2 7 60 (1863) name only, and Proc. Am. Acad. 6 205 (1864). *Tium variegatum* Rydberg. Pods 5-10 mm. long, larger above, obovate to clavate-oblong

and very oblique, the tip abruptly hooked and deltoid and ending in the long subulate style which is at right angles to the body, the ventral suture very concave, and the dorsal suture arched to a half circle and mostly sulcate to the middle and the suture a trifle produced as a thin edge, pod about 3 mm. high, rarely reflexed, very short-stipitate, puberulent, with ventral suture a mere line. Flowers white, veined with purple, about 5 mm. long, generally 2 at the end of the capillary peduncle. Banner nearly round, about 5 mm. long abruptly arched at end of calyx tube to erect or more, deeply notched, with sides but little reflexed. Wings broadly oblanceolate, 2 mm. wide, much arched and nearly as long as banner. Keel oblong and incurved to nearly a half circle from the base, much shorter than the wings and barely surpassing the calyx teeth, purple, much rounded at tip and upper corner about square. Calyx tube about 1 mm. long, and about as long as the subulate arched teeth, almost turbinate, nigrescent, acute at base, equally inserted on the filiform pedicels which are 4-6 mm. long and longer than the subulate and minute bracts. Peduncles about 5 cm. long, arched. Upper leaves sessile, the lower conspicuously petioled, 5-8 cm. long, with filiform and tapering rachis. Leaflets 5-6 pairs, about oval, inclined to be shortly-cuneate below, 5-7 mm. long, thin, all about the same size, the terminal one often obcordate, minutely appressed-pubescent. Stems 2-3 ft. long, almost filiform, with many internodes and the upper ones about as long as the leaves. Upper stipules the largest, triangular, 4-6 mm. long. Stems many, from a slender erect root which is much branched at the crown, as in *A. villosus*. In gravelly places in moist canons of northern Colorado from Canon City northward. Middle Temperate life zone.

Astragalus sparsiflorus* var. *majusculus Gray Proc. Am. Acad. 6 206 (1864.) Pods oblong-oblanceolate, about 2 cm. long, somewhat falcate, with the tip straight and not hooked and with suture convex at tip. Flowers racemose and about 6. Leaflets 6-8 pairs, elliptical to cuneate-oblong, fully 1 cm. long, long-petiolulate. Stems about a foot long and much branched. At first sight this seems like a well defined species, but it intergrades and often grows with the species. Mountains of Colorado west of Denver and Boulder and in Platte Canon. This is the normal well developed form.

ALPINI 6.

Pods papery, variously inflated, rarely large, on slender pedicels stipitate and pendent (erect in the first group), rather few-seeded in the middle, opening throughout the ventral suture; with ventral suture the more arched in young pods or when rarely concave in *A. andinus* in mature pods the tip is declined; with dorsal suture a mere thickened edge within or a little produced as a papery partial partition, the body rather oblique but nearly straight. Flowers small (about 1.5 cm. long in *A. Gormani* and the alpinus group). Stipules green and conspicuous (hyaline in *A. Gormani*), veiny, large or foliose, not connate (rarely so in *A. andinus*, free in *A. Gormani*), longer above on the stems, very broad near the root. Stem leaves fully or almost sessile (short-petioled in the *A. alpinus* group), with several pairs of thin, flat, rather narrow, green, and mostly obtuse leaflets. Plants blooming in summer and growing in high and cold mountains and mountain valleys. Phaca.

KEY

- A. Pods apparently sessile. Flowers in long racemes. Bracts triangular-subulate with thread-like tips, 3-7 mm. long. Leaves about sessile, about 1 dm. long, with 6-8 pairs of nearly linear leaflets cuneate at base and about 2 cm. long and rarely 5 mm. wide, and long-petiolulate. Peduncles elongated and strict, much longer than the leaves, and with rachis about half the peduncle.
- Pods erect and appressed. Arctic. 84 *Gormani*.
 Pods pendent. Subalpine. 85 *elegans*.
- 2A. Pods conspicuously stipitate and pendent, appearing almost sessile in some cases in *A. Labradoricus* var. *occidentalis*.
- 2AB. Stipules not very large nor leaf-like, acuminate above. Bracts small, and acuminate. Peduncles longer than the leaves. Flowers with purple-tipped keel, and mostly purple tinged above, not over 1 cm. long. Young pods inclined to be nigrescent. Calyx teeth triangular to subulate often as long as tube. Pods distinctly laterally flattened when mature, not sulcate or only slightly so, the dorsal suture intruded as a partial partition, but rarely 1 mm. high. The ventral suture greatly arched and the dorsal about straight. Flowers in long racemes (except in *A. Cottoni*). *A. arcticus* and *oroboides* are near this group.
- Pods narrow, 1-2 cm. long. Flowers stubby. Leaflets broad and not congested. Leaves 4-7 cm. long. Pubescence almost none. 86 *Labradoricus*
- Pods about half-oval, 2-2.5 cm. long. Flowers not stubby. Leaflets narrow, mostly congested. Leaves 4-10 cm. long. Pubescence minute or none. 87 *aboriginum*.
- Pods 2.5 cm. long, half-oval. Flowers not stubby. Leaflets elliptical. Leaves closely sessile, woolly. 88 *Cottoni*

2A2B. Flowers in spikes, white or cream-colored, about 1.5 cm. long, closely reflexed. Keel large and not purple-tipped, very obtuse and rounded. Wings short. Pods with dorsal suture thickened within but not raised as a thin edge. Stipules very large and leaf-like, fully 1 cm. long, reflexed, thin, obtuse, or the uppermost only acutish, oval to oblong. Peduncles subterminal, shorter than the leaves. Calyx white, very oblique at both ends, cut off at the lower corner and set obliquely to the long and filiform pedicel and inclined to be saccate on the upper corner, cleft much deeper above, with rudimentary and broadly deltoid teeth. Leaves all petioled. Leaflets very large, elliptical, contiguous, short-petiolulate, broadly cuneate below, obtuse, 2-4 cm. long.

Pods black-hairy.

89 alpinus.

Pods green and smooth.

90 Americanus.

2A3B. Pods distinctly obcompressed, the cross section triquetrous-reniform, somewhat inflated, nigrescent, conspicuously sulcate dorsally, with ventral suture straight or a little concave but with a convex hump near the tip and tip declined, on a stipe as long as calyx. Flowers in short racemes or clusters. Stipules large and leaf-like. Leaflets 10-12 pairs. Plants from filiform underground rootstocks.

91 andinus.

84. *Astragalus Gormanii* Wight. n. sp. Pods erect and appressed, oblong-lanceolate, straight, about 1.5 cm. long and 4-5 mm. wide and high, cross section apparently nearly round, partly 2-celled by the intrusion of the dorsal suture which is nearly straight, with the ventral arched, pod splitting the calyx, shortly acuminate, rounded at the sessile base, smooth. Flowers white, narrow, nearly 1.5 cm. long, reflexed. Banner elliptical, about 1 cm. long, abruptly arched to 45 degrees at calyx tips, with sides reflexed about 1 mm. wide throughout, 3-4 mm. longer than wings. Wings lance-linear, 1 mm. wide, arched about 30 degrees, 2 mm. longer than keel. Keel with straight base and exerted claw, about 4 mm long, 2 mm. wide, the tip abruptly rounded to about 110 degrees and deltoid, about 3 mm. high purple. Calyx about 4 mm. long and 3 mm. wide, ribbed, rounded at the fleshy base and nearly equally inserted, cleft much deeper above, hyaline and nigrescent with minute appressed hairs; teeth triangular, spreading and about 1 mm. long. Pedicels 2-3 mm. long. Bracts very narrow, hyaline and lax, about 7 mm. long. Peduncles stout, 2-3 dm. long. Leaves widely spreading, about 7 cm. long, and 4 cm. wide. Leaflets smooth, rather glaucous, obtuse, rather distant. Stipules subulate-lanceolate, papery and hyaline, adnate and not connate, about 7 mm. long, spreading, the lower much broader and rather longer. Stems about 2 ft. high, with the lower internodes longer, than the leaves, ascending, decumbent at base. Whole plant smooth except the calyx. Root woody and rather stout. This has the habit of *A. aboriginum*. It grows in moist ground on creek banks near Fort Selkirk Alaska, Upper Temperate life zone, blooming in July. Gorman. The Indian name is Ayan-Gih-thah.

85. *Astragalus elegans* (Hook.) Sheldon Minn. Bot. Stud. 9 154 (1894) *Phaca elegans* Hook. Fl. Bor. Am. 1 144 (1830). *A. oroboides* var. *Americanus* Gray, *A. Shearis* Rydberg, *Atelophragma Shearis* Rydberg. Pods half-oval, hardly 1 cm. long, 5-7 mm. high and about 3-5 mm. wide, a little laterally flattened, with cross section broadly ovate and rarely a little cordate when pod is slightly sulcate dorsally, dark, but white-hairy, obliquely deltoid at each end and with stout declined mucro at tip and a minute stipe at base, the ventral suture convex to about one third circle, the dorsal straight or a trifle

convex, pendent; dorsal suture intruded as a thin and narrow hyaline band; not explanate along the ventral suture throughout, scarcely at all splitting along the dorsal. Flowers in the type deep-purple, with light claws, 7-9 mm. long, narrow, in dense racemes 2-5 cm. long. Banner oval, about 4-5 mm. long, with sides a little reflexed throughout, arched abruptly at end of tube to 45 degrees, 1-2 mm. longer than wings, with white spot very strongly purple-veined. Wings lanceolate, hardly 1 mm. wide, arched to 45 degrees, about 1 mm. longer than keel. Keel with straight base, about 3 mm. long, 1-5 mm. high, and abruptly rounded to about 110 degrees and with the deltoid tip about 2 mm. high. Calyx tube about 3 mm. long and 1.5 mm. high, narrowed below and acutish at the base and inserted near the lower corner, very oblique at tip and much deeper cleft above, nigrescent, the lax and subulate teeth unequal and nearly as long as tube. Bracts subulate to triangular, 4-5 mm. long, longer than the flowering pedicels. Arctic plants have the papery bracts subulate, southern plants have triangular bracts hairy and stiffer. Stipules green, nearly deltoid, about 5 mm. long, the lower very broad and rounded, often overlapping their edges but almost never truly connate. Proper peduncles about 1 dm. long and longer than the leaves. Leaves all shortly petioled in the type, nearly 1 dm. long, rarely 3.5 cm. wide. Leaflets narrowly elliptical to broadly linear, 1.5-3.5 cm. long, ashy, mostly notched, rather distant. Stems 1-2 ft. high, nearly erect, the internodes about as long as the leaves, from rather much branched woody roots. From the plains of Alberta to Labrador and northward in the mountains to Alaska and the Arctic, in moist woods and meadows. Middle and Upper Temperate life zone blooming in July and August. This differs from *A. oroboides* of Europe in the narrow not oblong-ovate leaflets.

Astragalus elegans* var. *curtiflorus Rydberg Fl. Mont. 242 (1900). Pods and flowers in long racemes on elongated peduncles. Flowers hardly 8 mm. long, often lighter colored. Bracts about 2 mm. long. Upper leaves sessile. Stems and peduncles sulcate. This is the common form from Leadville Colorado to the British line in the mountains, not in the Great Basin but on the Pacific slope in Deer Lodge valley Montana, Upper Temperate life zone, also along cold streams in the Middle Temperate, in moist places in meadows and open woods.

86. ***Astragalus Labradoricus*** DC. Prod. 2 287 (1825). *A. secundus* Mx., *A. Blakei* Eggleston, *A. Robbinsii* var *Jesupii* Sheldon, *A. macounii* Rydberg. Pods 1-2 cm. long, 4-5 mm. wide or high, only slightly sulcate, shortly acuminate at both ends, in the young state quite narrow and inclined to be obcompressed but with age often laterally flattened, somewhat inflated, with dorsal suture a little produced. Stipe about as long as calyx. Flowers spicate, about 1 cm. long 10-15, about half of them maturing and the fruit racemose. Banner oval, about 7 mm. long, 2 mm. longer than wings, arched gently to 45 degrees about 2 mm. beyond calyx tips, with sides reflexed 2 mm. wide and most above and with claws included. Wings 2 mm. longer than keel, nearly linear, about 1 mm. wide, a little arched, much narrower than keel and exposing its base. Keel small, straight, about 3 mm. long, with tip rounded, obtuse, and as wide as high. Calyx about 3 mm. long, a little narrowed below, slightly oblique at tip. Teeth triangular, about 1 mm. long. Pedicels slender, horizontal in flower, longer than the bracts, 2 mm. long in flower and 4 mm. long in fruit. Bracts conspicuous, hyaline, lanceolate. Peduncles 1.5-3 dm. long, in the upper axils, racemes 4-12 cm. long. Leaves 4-7 cm. long, widely spreading, the upper sessile. Leaflets elliptical to oval, 1-3 cm. long, obtuse to notched, somewhat pubescent, about 5-6 pairs, not contiguous, shortly cuneate at base, fully 7 mm. wide, thin. Stipules triangular-lanceolate, 4-7 mm. long, mostly rather small for the plant but varia-

ble, the lower ones short and often reniform. Stems 1-2 ft. high, slender, tufted, ascending to decumbent, open and airy plants with internodes 4-10 cm. long. Pubescence of whole plant almost none except the nigrescent calyx and pods. Young forms of this closely resemble *A. andinus*, but the flowers of that species are capitate, the stipules broader and greener, the habit more decumbent and the pods as they ripen differ greatly. Alpine and subalpine from the mountains of New England to Labrador. Intergrades toward the var. *occidentalis* grow in Alberta and are *A. Macounii* Rydberg. This often passes for *A. andinus* in New England.

Astragalus Labradoricus var. *Robbinsii* (Oakes in Gray's Man. Ed. 2 98 (1856), as species). Pods much laterally flattened, about 1-1.5 cm. long and half as high, half-oblong-oval, with the dorsal suture straight and the ventral much arched, rather abruptly narrowed at both ends, and shortly acute, opening first at tip, but little inflated though the cavity is much wider than the seeds, septum a little intruded. Flowers capitate to short-racemose, 7-10 mm. long, ascending, white. Calyx cleft deeper above and with broad sinus; teeth one-half to one mm. long. Bracts small, lanceolate, those on the lower flowers larger. Leaflets 7-12 mm. long, oval to oblong, 3-5 pairs, long-petiolulate. Stipules green, rather large. Stems variably erect. Pubescence appressed and nigrescent, not dense. Alpine in the mountains of New England.

Astragalus Labradoricus var. *occidentalis* (Watson Bot. King 70 (1871) as *Robbisii* var.) *A. occidentalis* (Watson) Jones. *Atelophragma* Rydberg. Body of pod 10-15 mm. long, rarely 2.5 cm. long, shortly acute at both ends, half-oval to half-elliptical, about 7 mm. high in the short pods and 3 mm. wide and high in the long pods, mostly half-oval-ovate nearly as wide as high, cross section rather broadly ovate, pod inflated, on a twisted pedicel so that the dorsal suture is mostly uppermost, often a little sulcate dorsally, in long racemes nigrescent, with dorsal suture intruded often 1 mm. high. Stipe normally about half as long as calyx but very variable from very short to a little longer than calyx, when very short it approaches *A. elegans*. Flowers rather many, ascending to horizontal, spicate, dirty-white but often tinged with purple, purplish below, about 7 mm. long, rather narrow. Banner oblong-oval abruptly arched to 60 to 90 degrees 1 mm. beyond calyx tips, 7 mm. long, 1-2 mm. longer than wings, with sides reflexed about 1 mm. wide; groove very broadly V-shaped below and disappearing above. Wings arched to 30 degrees, narrower than keel and about 1 mm. longer, obovate, rounded, notched below the tip, with a little groove along the middle, concave to keel and oblique, right hand one pressed close to keel. Keel with tip nearly erect and rounded, 2 mm. high, about 3 mm. longer than calyx, lead-purple. Calyx tube about 2 mm. long, almost turbinate, truncate, very oblique above, cleft deeper above with broad sinus, teeth deltoid at base. barely half as long as tube, with pedicel about equally inserted. Bracts green, lanceolate to subulate, not over 2 mm. long. Peduncles as often axillary as terminal with the rachis often a foot long. Leaves not condensed, not over 1 dm. long. Leaflets oval to oblong, rarely 12 mm. long (northern forms often have leaflets 3 cm. long), smooth or nearly so, 6-7 pairs, green, often paler below. Stipules large, rarely a little connate at very base. Stems widely spreading over other plants or prostrate, 1-2 ft. long. Crowns rather many from a woody and erect root, not from underground and slender rootstocks as in *andinus*. This differs from the var. *Robbinsii* in the less lunate pods, about equally acute at both ends but very shortly stipitate, and in the more numerous leaflets. But it is exceedingly variable in all characters. It often grows with *A. andinus* and may hybridize with it. Alpine and subalpine. East Humboldt Mts. Nevada to the Blue

Mts. Oregon and northward and eastward to Colorado but not found in Utah so far. *A. Macounii* is a form intermediate between this and *A. Labradoricus* and is the more common northern form. It occurs in the mountains of Alberta and along the border in British Columbia and as far westward as Upper Marias Pass in Montana and Oroville in the Cascades, Washington, but is mostly replaced in the northwest by *A. Bourgovii* with connate stipules. In rocky meadows.

87. *Astragalus aboriginum* Rich. in Frankl. Jour. App. 18 (1823). Phaca Hooker, Homalobus and Atelophragma Rydberg. Pods half-oval, about 2 cm. long exclusive of the stipe, and about 5 mm. high, triangular acute at tip and apiculate, and also acuminate into the tapering stipe which is longer than the calyx, about smooth and brownish when ripe, opening all along the ventral suture. Cross section rather ovate. Flowers 7-12 mm. long, stubby, capitate, sometimes white. Banner abruptly arched to nearly erect at end of calyx, fleshy, about 2 mm. longer than keel, oval, 3-4 mm. long, with sides reflexed about 1 mm. wide. Wings arched to nearly erect, rather cuneate and lobed at tip and about 2 mm. wide, about 1 mm. longer than keel and 1 mm. shorter than banner. Keel with base generally arched a little and tip triangular or deltoid and at least abruptly erect, about 3 mm. high. Calyx tube hardly 2 mm. long, obliquely campanulate, rather narrowed below and inserted near the lower corner, the base straight and upper side arched, cleft deeper above, the teeth nearly as long as tube and nigrescent with black wool. Pedicels about 2 mm. long and shorter than the hyaline bracts which nearly equal the calyx tube. Peduncles sulcate, in fruit about twice as long as leaves and the fruiting rachis as long or longer than the peduncles. Leaves mostly sessile, wide, 4-10 cm. long. Leaflets 5-6 pairs, linear in the type, about 2 cm. long, 2-4 mm. wide, rather distant in the type and ascending, acutish, often subalternate, variously hoary to almost smooth, with straight and appressed hairs, pubescence deciduous. Stipules about 5-7 mm. long, conspicuous. Stems slender and nearly erect in the type, a foot or two long, from a thick and yellow root. Much used by the Indians for food. Frequent in open and rocky woods from Lake Winnepeg to British Columbia in the rocky Mountains to the Yukon. Middle and Upper Temperate life zones.

Astragalus aboriginum var. *glabriusculus* (Hook.) Rydberg Cont. Nat. Herb. 3 492 (1896). Phaca glabriuscula Hooker Fl. Bor. Am. 1 144 (1830.) *Astragalus glabriusculus* (Hook.) Gray and var. *major* Gray. *A. Forwoodii* Watson. This is the common form with narrowly elliptical leaflets nearly or quite smooth. From Veta Pass Colorado to the East Humboldt Mts. Nevada and northward. Rare in the Great Basin. Mt. Belknap Utah. *A. Forwoodii* is an intermediate form.

Astragalus aboriginum var. *fastigiorum* n. var. This is a densely congested form with many nearly prostrate stems with few nodes and sharp leaflets densely congested making the leaf about as broad as long, and with inflorescence often longer than the stems, and pubescence variably woolly to straight. Alpine or subalpine, most common on high ridges from Montana to the Wallowa Mts. Oregon. The type is my material from Mr. Haggin Montana, and to it I refer Cusick's from the Wallowas.

88. *Astragalus Cottoni* n. sp. *A. Olympicus* Cotton Torr. Bull. 29 573 (1902). Pods with body 2.5 cm. long and about 1.2 cm. wide, nearly half-oval but with the dorsal suture a little arched, otherwise it would be half-oval, rounded at tip and with a minute recurved apiculation in line with dorsal suture, triangular at base and acutish where it ends in the filiform stipe which is twice the calyx and about 6 mm. long, minutely pubescent and papery, nearly the shape of *A. leucopsis* but with sutures reversed, the ventral suture being greatly arched, pods ascending from a pendent calyx. Dorsal suture intruded as a thin and

lacerate edge, 1 mm. wide. Flowers white with purple tips, about 1 cm. long, arched, widely spreading. Banner nearly round, about 8 mm. long, 7 mm. wide, about 2 mm. longer than wings, with sides reflexed below. Wings deeply notched, broadly oblong, 7 mm. long, 2 mm. wide, a little longer than keel. Keel with rather straight base, then abruptly curved to a half circle, very thick, purple and very obtuse. Calyx tube about 3 mm. long, nigrescent, oblique and narrowed below to the slender pedicel which is 2 mm. long, with teeth triangular-subulate, spreading and over half as long as tube. Peduncles about 7 cm. long, longer than leaves, rather stout, the rachis about half as long. Leaves and stipules as in *A. aboriginum*, closely sessile and with 5-6 pairs of leaflets which are elliptical, about 1.2 cm. long and 4 mm. wide, and barely acute. Stems branched and many from the crown. Pubescence softly and rather sparsely woolly. On the alpine summits of the Olympic Mts. Washington, Elmer. This seems more like an extreme form of *A. aboriginum* than a good species.

89. *Astragalus alpinus* (L.) Sheldon Minn. Bot. Stud. 9 65 (1894). *Phaca alpina* L. 755. *A. frigidus* (L.) Gray. Pods nigrescent, very gibbous, acute at both ends, oblong 2-3 cm. long, often 1 cm. wide, on a stipe hardly as long as calyx, inclined to be sulcate dorsally, conspicuously inflated. Flowers few to many, broad, short and stubby, about 1.5 cm. long. Petals all about equal, with fleshy claws. Banner gently arched to 45 degrees 2 mm. beyond calyx teeth, with sides reflexed toward the tip about 2 mm. wide. Wings oblanceolate, 2 mm. wide, nearly straight, half as wide as the lunate keel. Keel broad, obtuse. Calyx tube about 5-7 mm. long, 2 mm. high, the teeth variable from a mere rudiment to shortly triangular. Bracts 7-10 mm. long. Leaves 4-7 cm. long, even the upper short-petioled, the lower ones with petioles longer than the adjoining leaflet. The rachis grooved. Leaflets 4-5 pairs, mostly oblong-ovate, variably black or white-hairy below, smooth above. Stems stout, about a foot high, erect and little branched, from slender root-branches. Throughout the Arctic regions of the World. In the type the calyx is nearly smooth, the American forms are nearly all the following. Plants growing in the tundra and humus.

Astragalus alpinus var. *littoralis* (Hook.) Sheldon Minn. Bot. Stud. 9 133 (1894), *Phaca frigida* var. *littoralis* Hook. Fl. Bor. Am. 1 140 (1830) *A. frigidus* var. *littoralis* (Hook.) Watson. Pods elliptical, shortly-acute at both ends, somewhat obcompressed, not sulcate, with stipe 2-3 mm. long. Flowers capitate, cream-colored, with white margins. Banner about 7 mm. long, and 1 mm. longer than keel. Wings obovate to narrowly oblong, about 2 mm. wide. Keel rounded and gently arched from base, blunt, about 3 mm. high. Calyx softly black-hairy, the upper side convex, the lower straight, teeth triangular and about half the tube or less. Bracts rather small, 2-7 mm. long. Leaflets hoary below, 3-6 pairs, sparsely woolly, lance-oblong to oblong-oval or ovate, 2-3 cm. long, 4-10 mm. wide or more, obtuse or retuse or even acutish. Stems sulcate, 1-2, 7-10 cm. long in fruit, but hardly 5 cm. long in flower. This is the common Alaskan form.

90. *Astragalus Americanus* (Hook.) Jones Cont. 8 8 (1898). *Phaca frigida* var. *Americana* Hook. Bor. Am. 1 140 (1830). *Phaca Americana* Rydberg. *A. alpinus* var. *Americanus* (Hook.) Sheldon. Pods smooth and green, very thin, elliptical and triangular-acute at both ends, the body about 2.5 cm. long and 1 cm. wide, on a stipe about twice as long as calyx, with ventral suture conspicuously arched, with dorsal-suture a little broadly sulcate and a mere rib within, inclined to open first at base, often black with minute hairs when young. Flowers about 1 cm. long, rather many in a dense spike, white, the banner oval and a trifle longer than wings which are

barely longer than the keel, about 6 mm. long, arched gently from calyx to nearly erect, thick, the thin white margins reflexed about 2-3 mm. wide. Wings oblanceolate and rounded, barely 2 mm. wide. Keel very obliquely elliptical, the obtuse tip ascending mostly to 45° , about 2 mm. wide. Calyx tube about 5 mm. long and 4 mm. high, smooth except at the rudimentary teeth, the teeth almost obsolete. The filiform pedicels conspicuous, 4-10 mm. long. Bracts nearly equaling the calyx. Leaves 1-1.5 dm. long, with very short petioles. Leaflets 5-9 pairs, ovate to oblong-elliptical, lighter below and sparsely pubescent with very short and woolly hairs, often 5 cm. long, rounded to notched. Stems stout, 2-3 ft. high, strict, from slender but rather woody roots. Occasional from Dakotah and northern Colorado in subalpine valleys around the edges of woods to the Arctic, northwestward to the head of the Bitterroot in Montana at Alta. Not in the Great Basin nor (so far) reported from the western edge of the Columbia Basin.

91. *Astragalus andinus* (Nutt.) Phaca andina Nutt in T. & G. Fl. 1 345 1838, *A. astragalinus* (L.) Sheldon, Phaca astragalina L. 196. The necessity for adopting the Phaca alpina L. for the *A. frigidus* L., because of the Vienna rules, requires renaming the *Astragalus alpinus* of Linnæus. For evident reason I do not adopt the senseless name *astragalinus*, nor the already preoccupied *A. giganteus* of Sheldon, another equally senseless name for this diminutive plant. Pods as well as flowers capitate or very shortly spicate, 1-1.5 cm. long, 3-4 mm. wide, rarely 3 mm. high, obliquely oblong, nearly straight, closely reflexed, shortly and abruptly acute at both ends to triangular and even acuminate at base, the longitudinal section generally elliptical from side to side, black-hairy and mostly shaggy, but variable with dorsal suture from conspicuously produced half way to a mere line within. Flowers 7-12 mm. long, purple-tipped, rarely all purple, capitate when many, sometimes few, and pods reduced to a single terminal one or few, or many, generally 6-12 mostly widely spreading and soon closely reflexed. Banner obovate to oval, 5-10 mm. long, rather abruptly arched to 30 to 90 degrees at calyx tips or 2 mm. beyond and when much reflexed seems remote from keel, about 1 mm. longer than keel or less, with the obovate and rounded white spot conspicuously purple-veined, with sides reflexed most in the middle and 2 mm. wide; groove V-shaped and vanishing above. Wings oblong-clavate, 2 mm. wide, about 5 mm. long, about as long as or a little shorter than keel, neither grooved nor notched, pale to white, straight, or ascending 30 degrees. Keel very large for the flower, straight, the base straight and then arched variously but rarely to erect, the general outline being clavate and broadly oblanceolate, the tip 3-4 mm. high and about 3 mm. wide, triangular and rounded to nearly acute, about as long as banner and very prominent. Calyx tube campanulate to hemispherical, a trifle laterally flattened, cleft deeper above with narrow sinus, a trifle oblique at base but equally inserted, about 2 mm. long; teeth triangular, unequal, variable but not as long as tube. Pedicels about 2 mm. long and equaled by the hyaline bracts. Peduncles subterminal, stout for the plant, 7-10 cm. long, ascending, longer than the leaves, very sulcate. Leaves all petioled except the uppermost. Leaflets oval to elliptical, 7-10 mm. long, obtuse, rarely retuse, gradually smaller above, mostly 10 (6-12) pairs, the northern forms rather silky with sparse, white, long and fine, loosely appressed hairs, but the southern forms almost smooth. Stems almost filiform, flexuous, with few long internodes, the lower ones mostly short, weak and flat on the ground, or with ascending tips, much branched, rarely a foot long, forming loose and open mats. Stipules conspicuous green, large, rather deltoid. Very variable plants in size of flowers, length of stipe, and width of pods. European pods are often half as wide as long. Western flowers are mostly small though the large

European flowers are not uncommon. Common in all the higher mountains of Colorado and northern New Mexico and Utah to the East Humboldt Mts. Nevada and northwestward through the Blue Mts. to the Cascades, northward to Montana and the Arctic. Alpine and subalpine, also growing in cold meadows at the north in the Middle Temperate at Flathead Lake Montana, etc. Growing in gravelly places along rivulets.

COLLINI 7.

Pods somewhat fleshy when green, coriaceous (almost cartilaginous in *A. Gibbsii*.) not inflated, linear or nearly so, elongated, stipitate but stipe not jointed nor the pod jointed to it, 1-celled and with sutures not at all intruded, laterally flattened (rarely obcompressed in the middle in *A. Gibbsii*), inclined to split first at base along both sutures and through the the stipe but with valves not curling, with both sutures thick and raised externally and rib-like, pod acuminate or triangular-acute at both ends, flat-beaked, arcuate (rarely straight in *A. collinus* and *Tweedyi*) often to a circle or more, with the ventral suture concave and the tip in line with it, opening first at base, rarely at tip. Flowers cream-colored, 7-15 mm. long, racemose and mostly densely so, variously reflexed, stubby. Banner mostly much recurved and fleshy at base, with wings inclined to extend beyond it and these mostly much longer than keel, banner blade often shorter than calyx tube. Keel short and long-clawed, with tip erect abruptly or a little more than erect, about 3 mm. high. Calyx short-cylindric to campanulate, inclined to be a little inflated, hyaline, cream-colored, very oblique at both ends, the upper side arched to nearly one third circle, the lower side straight, inclined to be saccate on the upper corner at the insertion and inserted on the lower corner which is mostly cut away a little there, the calyx reflexed and mostly inserted at right angles to the pedicel which is relatively slender, erect, and as long as the minute and mostly subulate bract, 1-3 mm. long. Peduncles in the upper axils. Internodes many and short, the uppermost the shortest. Leaves short, 2-10 cm. long, widely spreading, almost sessile. Leaflets 4-7 pairs, nearly contiguous, long-petiolulate, thickish but not fleshy, from nearly round or obovate to nearly linear, truncate to deeply notched at tip, not over 1.5 cm. long, often folded, subalternate, minutely woolly (smooth in *A. porrectus*) with fine white hairs which are attached by the larger base and then arch over and with tips variously appressed and wavy but not abruptly appressed at attachment as is the case with most species with appressed hairs. Stems flexuous, slender, erect or nearly so, much tufted, more pubescent than the leaves, 1-2 ft. high, with branches often widely spreading. Stipules and bracts small or minute, rigid, greenish. Perennials of the Columbia Basin and along the eastern side of the Sierras only. Middle and Lower Temperate life zones, growing on grassy or sagebrush plains and blooming in summer.

KEY

A. Pods 1.5-2 cm. long, 2-3 mm high, straight or little arched, laterally flattened, on a stipe about half as long as pod, and which is fully as long as calyx. Peduncles strict, often a foot long.: Stems erect. Leaflets nearly linear, about 1.5 cm. long. Flowers about 8 mm. long, the banner very stubby and arched almost back on itself, round, 3-5 mm. long. Calyx about 6 mm. long, the teeth about a fourth as long and deltoid.

Pods erect. 92 Tweedyi
 Pods not erect. 93 collinus.

2A. Pods arched, 2-3 cm. long exclusive of stipe.

2AB. Rather coarse plants, mostly 2-3 ft. high, from thick and woody roots. Peduncles stout and as long as leaves. Flowers nearly 2 cm. long, rather coarse. Calyx tube about 8 mm. long and 4-5 mm. high, pendent. Leaflets large.

Flowers large and stubby. Pods not spirally coiled. 94 Gibbsii.

2A2B. Slender plants with flexuous stems rarely a foot high and much branched, from slender roots. Peduncles slender and and shorter than the leaves. Flowers not over 1.5 cm. long, in short racemes, not coarse. Leaflets small, 5-10 mm. long. Pods very flat, almost completely laterally flattened and with sharp edges, on filiform stipes, tightly coiled into 1-2 circles, the body about 2 cm. long, the walls mostly separating with age, and the outer wall contortedly reticulate and the main veins ascending along the sutures and pods spirally coiled, with tip ensiform and very sharp.

Flowers large, 1.5 cm. long, not stubby. Pods spirally coiled. Stipe only equaling calyx. 95 speirocarpus.

Flowers 7 mm. long. Stipe 3-5 times as long as the calyx. 96 Alvordensis.

92. *Astragalus Tweedyi* Canby Bot. Gaz. 15 150 (1890.) Phaca Piper. Pods erect, about 1.5 cm. long, rigid and reticulated, almost cartilaginous, opening first at tip, about 4 mm. high, cross section nearly round. Along the Columbia at the mouth of the Yakima river. Lower Temperate life zone.

93. *Astragalus collinus* Dougl. in Hook. Fl. Bor. Am. 1 141 (1830). Phaca Hooker. *A. cyrtoides* Gray. Pods pendent, opening first at base, about 2 cm. long and 3 mm. high, faintly reticulated, mostly much flattened laterally, coriaceous. Grassy and sandy hills and flats. Stems about 2 ft. high. Middle Temperate life zone nearly throughout the Columbia Basin (except the valley of the Snake) and common on the west. The type of *A. cyrtoides* from the Clearwater is clearly *A. collinus*. The same sheet has a specimen of *A. Gibbsii* var. on it, and the shape on this gave the name undoubtedly since there are only flowers on the Clearwater specimen which forms the type of *A. cyrtoides*. Gray evidently thought the two specimens belonged to the same species, which was not correct.

94. *Astragalus Gibbsii* Kellogg Proc. Cal. Acad. 2 161 f. 50 (1863). *A. sinuatus* Piper. Phaca Piper. Pods variously arched even into a circle, inclined to be acuminate at both ends, long-pointed, 4-5 mm. wide or high, often decidedly obcompressed in the middle. Rather cartilaginous and corrugated and about round in the type, opening first at base, the tip mostly erect, on a stipe about half as long as body. Flowers many, in a dense spike-like raceme. Banner very short, and stubby, mostly broader than long and greatly reflexed, the erect part 3 mm. high or less, about half as long as calyx tube, or nearly as long, which is about 8 mm. long and 5-6 mm. high. Wings broadly oblong, 3 mm. wide below and 2 mm. at the twisted and horizontal

tip, 2 mm. longer than keel. Keel purple-tipped. Leaflets oblong-obovate, rarely oblong-ovate, with cuneate base, about 1.5 cm. long, notched. Whole plant even to calyx and pods finely and very shortly-woolly. Common around Reno Nevada and northward, rare in the Columbia Basin along the divide and running over to the Blue Mts. and as far as Weiser Idaho, also extending down the Klamath river. Nearly everything referred to the species from the Columbia Basin is the variety.

Astragalus Gibbsii var. *curvicarpus* (Sheldon Minn. Stud. 9 125 (1894) as *A. speirocarpus* var.) *A. speirocarpus* var. *falciformis* Gray. Pods nearly smooth, about 3 mm. high, much laterally flattened, often curved to a circle, triangular-acute. Flowers rarely over 10 in a short spike, the banner ovate and as long as calyx, wings elongated, 2 mm. wide, arched, flaring at tip, 3-6 mm. longer than keel. Stems slender and ascending. Whole plant nearly smooth. This extends from Austin Nevada to the Sierras and northward along the rim of the Columbia Basin to Baker City Oregon and Nampa Idaho.

95. *Astragalus speirocarpus* Gray Proc. Am. Acad. 6 225 (1864.) *A. Whitedi* Piper. Pods triangular-acuminate at both ends, 4-6 mm. high, evidently spirally reticulated, puberulent, on a rather stout stipe about as long as calyx. Flowers about 1.5 cm. long, with exerted claws, rather many. Banner ovate and about 8 mm. long, with sides a little reflexed, rather gently arched to 45 degrees beyond calyx, about 4 mm. longer than keel. Wings about straight, narrowly oblong, a little longer than keel. Keel about 3 mm. long and 2 mm. high, the tip abruptly erect and triangular, base straight, the claw very long. Calyx 5-8 mm. long, and 3 mm. high, about cylindrical, but with the usual shape, reflexed; teeth rudimentary, variably nigrescent with very short lax hairs. Peduncles rarely 5 cm. long, the rachis about as long. Leaves 5-7 cm. long, with 4-8 pairs of oblong-obovate, notched leaflets nearly 1 cm. long. Plants ashy throughout. Sand dunes from Near Yakima and along the Columbia near Wallulla on dry prairies.

96. *Astragalus Alvordensis* Jones Cont. 10 67 (1902). Pods shortly-triangular at tip and rather long-acuminate at base, about 3 mm. high, faintly reticulated, almost chartaceous, (somewhat, mottled, hardly 1 mm. wide, often a trifle and very narrowly sulcate dorsally, rather shining, on a filiform stipe about 1 cm. long and 3-5 times as long as the calyx. Flowers about 7 mm. long, purple-veined, widely spreading, racemose, 3-8 (pods 1-3), on a rachis 3-7 cm. long and with peduncle rarely over 1 cm. long. Banner ovate, arched abruptly beyond calyx teeth to erect, about 2-3 mm. long, with sides much reflexed. Wings lanceolate, narrow, abruptly arched near the end of keel to 45 degrees, about 1 mm. longer than keel and 2 mm. shorter than banner. Keel with straight base, 3 mm. long, tip abruptly erect and obtuse, all petals purple-veined. Calyx turbinate-campanulate, about 2 mm. long, 5-nerved, deeper cleft above and with oblique mouth, narrowed and obliquely inserted at base. Teeth minute and deltoid. Pedicels hardly half as long as calyx tube. Peduncles filiform and axillary throughout. Leaves about 2-4 cm. long, the petiole none or about as long as lowest leaflet. Leaflets 6-8 pairs, cuneate-obovate, notched 4-7 mm. long, rather hoary, less so above. Stems very slender and widely branched, 1-1.5 ft. long, ascending. Alvord valley eastern Oregon Cusick, June. This unique species seems like *A. speirocarpus*, a delicate form, but the flowers are very different and the stipe greatly elongated and the pod much thinner and the walls not old enough to determine if they split away as in the other species. The habit is that of *A. flexuosus*. Middle Temperate life zone, probably growing in sand.

PODO-SCLEROCARPI. 8.

Pods fleshy when fresh, cartilaginous or with thick woody walls when dry (coriaceous in some forms of *Toanus*), not jointed to calyx or stipe, neither suture evident when fresh but both conspicuous, thick and raised when dry, little if at all inflated, 1-4 cm. long, strongly cross nerved, never linear, rarely less than 1 cm. wide, never more than puberulent, not explanate, very strongly beaked, racemose. Flowers 1-2 cm. long, large, mostly white, with elongated banner and wings. Bracts short and triangular, inconspicuous, shorter than the mostly short and the stout fruiting pedicels. Pods and flowers mostly reflexed. Stems green and rush-like, and with the leaves, and petioles much alike. Stipules rigid and small, deltoid at base, reflexed above and green, hyaline below. Leaflets distant, fleshy, mostly almost filiform and thick, never more than linear, often obscurely if at all jointed to the rachis. Plants of the valleys and alkaline springs or in alkaline soil, perennials

KEY

- A.** Pods wholly 1-celled, the dorsal suture a trifle intruded in *A. pterocarpus*.
- AB.** Pods sessile at least when fresh, stipe if any when dry very short and thick.
- ABC.** Pods opening nearly equally at both sutures from the tip to the middle, rarely sulcate, about 1.5 cm. long, laterally if at all compressed, about straight. Stipules hyaline and connate toward the base of the stems, green and free above. *Pectinati*.
- ABCD.** Pods oblong to lanceolate, smooth, distant, full of pulp, not inflated, racemose on long and terminal peduncles, with beak flat, elongated and prow-like. Flowers purple, large and elongated, about 2 cm. long, with long wings and banner and purple-tipped keel. leaflets none to 5 pairs, filiform except some of the lowest, jointed to the rachis and like it. Upper leaflets simple and rarely at all enlarged at tip. Tall and slender and densely tufted plants.
- Pods erect. 97 *Toanus*.
 Pods reflexed. 98 *Rafaelensis*.
- ABC2D.** Pods not decidedly laterally compressed, oval to oblong straight, scarcely at all oblique, cross section nearly round, abruptly contracted into a stout conical beak, both sutures arched, the ventral a trifle the more, sometimes a little dorsally, both sutures very thick, about 1.5 cm. long. Flowers many in short and dense spikes, horizontal to a little reflexed, mostly white, 1-1.5 cm. long, straight, with exerted claws, blades very long. Banner elliptical-oblongate, sides much reflexed, ascending in a gentle curve to nearly

erect or less. Wings oblong to narrowly oblong, oblique and rounded, scarcely arched, about 4 mm. longer than keel, very thin. Keel 7 mm. long, straight, the tip abruptly arched to erect and broadly deltoid and 3 mm. high. Calyx like that of *Toanus* but rather narrower, slightly oblique at tip, hyaline, sinuses rounded, teeth much shorter than tube. Pedicels stout, in fruit 2-5 mm. long, in flower very short and about as long the subulate bracts. Peduncles angled, rarely as long as the leaves, stout. Leaves about 2.5 cm. long, ascending, the middle ones the largest. Petioles almost none, angled. Leaves very wide and short. Leaflets coarsely 1-nerved, about 3 pairs (rarely 10 pairs in *pectinatus*), 2.5-5 cm. long, linear when flat, almost filiform when folded, rarely linear-oblongate, often alternate, arcuate, acute, mostly not jointed to the short rachis. Stipules green, reddish below, very long tipped. Stems sulcate strongly, nearly 2 ft. high, not tangled, moderately stout, barely flexuous, with internodes shorter than the upper leaves. Plants ashy-pubescent. Stipules conspicuous. Pubescence of broad and flat hairs attached by base and closely appressed. Roots stout thick and erect. From the Green river bad lands of Wyoming to Kansas and northward in alkaline soil. Upper part of Lower and lower part of Middle Temperate life zones.

Pods erect.

99 Grayi.

Pods reflexed.

100 *pectinatus*.

AB2C. Pods opening most along the ventral suture except at tip and mostly first at tip. Ventral suture either straight or concave, never arched as much as the dorsal. Sutures not raised in the green state, but evidently so in the dry. Pods inclined to be obcompressed, angled or winged when dry, strictly 1-celled (the dorsal suture a trifle impressed in *pterocarpus*) conspicuously falcate, not inflated, ascending as well as flowers. Stems rather zigzag and flexuous. Leaves narrow, short-petioled, with several pairs of mostly straight leaflets. Stipules small, not connate.

AB2CD. Pods with rounded sides, not all angled or winged, purple or mottled, oblong-lanceolate and acuminate at tip and shortly so at base, about 1 cm. wide. Flowers purple, racemose, loose. Stems few in a place and inclined to be decumbent. Growing in well drained gravelly sagebrush slopes preferably where there is a little alkali seep.

Pods narrow, nearly round in cross-section.

101 Casei.

AB2C2D. Pods when dry laterally winged and with wings 2 mm. wide, sessile, erect (as well as the flowers except rarely in *A. pterocarpus*), acute but not acuminate at tip, obtuse but narrowed at base, very finely cross-veined, smooth, 3-4 cm. long, arcuate, with sutures narrow and not much thickened. Flowers short-spicate. Calyx triangular-acute at base, the lower side straight, upper side a trifle arched, attached on lower corner, hyaline. Terminal leaflet not jointed to rachis, leaflets not early deciduous but attached by very delicate petiolules, linear, rarely the lowest ones narrowly oblong. Leaves not widely spreading. Densely tufted stems slender and nearly straight, erect, freely branched mostly, from woody root, succulent and very hard to dry. Growing in low places.

Pods broad, much obcompressed and 2-winged.

102 *pterocarpus*.

Pods narrow, not flattened, 4-winged.

103 *tetrapterus*.

A2B. Pods conspicuously stipitate, with stipe longer than calyx and recurved, and the body very falcate upwards, acuminate at both ends but most at base, opening first at base and through the stipe, much laterally flattened at tip and base, conspicuously obcompressed in the middle when mature and corrugated finely, not hairy, rounded on the sides but appearing almost as if winged at the thick and raised sutures when dry, and cartilaginous, elongated-lunate, 2-5 cm. long including the stipe. Leaflets several pairs, narrow, all jointed to rachis by slender petioles, obtuse. Flowers 1-1.5 cm. long, the petals not elongated nor stubby, ascending. Calyx campanulate to short-cylindric, about 5 mm. long, hyaline and black-hairy, the teeth shorter than the tube. Pedicels short and stout, recurved in fruit. Bracts ovate to triangular, 1-2 mm. long, about as long as pedicels. Banner arched 45 to 80 degrees remote from calyx tip, the blade 9 mm. long and with sides reflexed. Wings narrowly oblong, arched 15 to 20 degrees, 2 mm. shorter than banner. Keel wide, the tip rounded and very obtuse, straight, incurved at tip to 80 to 100 degrees. Stipules small, green. Stems tufted from a woody root, about 2 ft. high, rather flexuous, with internodes less than half as long as the leaves, somewhat ashy throughout. Plants of the upper edge of the Lower Temperate life zone, in dry places, blooming in early summer. Sclerocarpi.

Pods narrow, acuminate at both ends.

104 sclerocarpus.

- 2A.** Pods either wholly or partly 2-celled by the intrusion of the dorsal and ventral sutures but partition never complete by the union of the sutures, with the tip 1-celled, mostly slightly inflated, 1.5-4 cm. long, 5-7 mm. high, 7-10 mm. wide, inclined to be a little obcompressed except in *A. pachypus*, smooth, very fleshy and nearly round when fresh, with firmer inner wall, the pulp about 1 mm. thick, the cavity filled with pulpy fluid when green, coarsely wrinkled or cross-ringed and woody when dry, never reflexed, oblique, oblong, a little arched by the ventral suture being concave and raised, abruptly contracted into a stout conical-subulate beak 2-5 mm. long, with sutures prominent externally, opening along the ventral suture and first at tip. Flowers and pods ascending, the former rather narrow, loosely racemose, widely spreading, rather few on the upper third of peduncle, about 2 cm. long. Banner oblong-ovate, gently arched to 60 to 80 degrees at calyx tips, with sides reflexed to midrib most below, with tip notched. Wings oblong, oblique, 1 cm. long, obtuse, concave to keel, with tips touching beyond it, longer than keel and much shorter than banner. Keel blade about 3 mm. Petals thin and with exerted claws. Calyx tube narrowed below to the lower corner where it is attached by a slight angle to the pedicel, somewhat fleshy below, cleft deeper above, laterally flattened; teeth triangular-subulate. Bracts about 2-3 mm. long, triangular-subulate to ovate. Pedicels in fruit stout and woody, about 3 mm. long. Peduncles stout and strict, 1.5-3 dm. long including the floral rachis, twice as long as the leaves. Middle leaves the longest. Leaflets all jointed to petiole, thick and leathery and fleshy, at least some of them linear. Proper petioles short but rachis of leaf and tapering and 1-1.5 dm. long. Stems straggling upward, not very stout, sulcate, branched below. 1-2 feet high, flexuous. Internodes much shorter than the leaves. Stipules rigid, green, reflexed, small. Pubescence minute, ashy. Alkali-loving plants of the Lower Temperate life zone. Pachypodes.
- 2AB.** Pods splitting to the middle from the tip along both sutures, sessile when fresh (the drying of the flesh makes it seem a little stipitate.) Flowers purple-tipped, in rather long and very

loose racemes. Banner greatly elongated and much longer than the wings and short keel. Wings nearly straight, about 3 mm. longer than keel, 2 mm. wide. Keel about 5 mm. long, abruptly arched to 90 degrees at the very obtuse tip which is as high as the base is long. Calyx tube oblong, about 7 mm. long, 3 mm. high and 1.5 mm. wide, the teeth about half to a third as long. Leaflets 1-3 pairs, all but the lowest sharp and linear, flat, often falcate, inclined to taper above, very distant.

Leaflets linear.

106 *Serenoi*.

Leaflets lanceolate or broader.

107 *canonis*.

2A2B. Pods with thick and jointless stipe which is fully as long as calyx, the pod narrowly oblong, short-pointed, arcuate, and with the stout and arched stipe forming a third of a circle, not completely 2-celled because the two sutures though touching do not unite, much laterally flattened when dry and with the partition splitting double and the pod opening at tip at at both sutures for a short distance only and the dorsal opening to the base and into the stipe but not through it nor the partition. Flowers shortly racemose and rather few, nearly horizontal, white. Calyx tube campanulate, abruptly contracted below, with the upper side arched and the lower straight, reflexed in fruit but the pod erect, with teeth as long as tube. Leaves about 1 dm. long, with slender rachis and somewhat tapering, and with many obtuse and mostly folded leaflets about 1-2.5 cm. long. Stems hoary, rather weakly ascending and little branched, shrubby below, 2-4 ft. long.

Pods narrow, on a very thick stipe.

108 *pachypus*.

97. *Astragalus Toanus* Jones Zoe 3 296 (1893). Pods acuminate, lanceolate to oblonglanceolate, appressed and erect, mostly decidedly laterally flattened, in short racemes at the tip of peduncle which is strict. The sutures evident but not very thick uniting in a pungent and triangular beak, body slightly cross-ribbed, with the ventral suture about straight, the dorsal arched. Texture coriaceous when dry but with the walls much thinner than in other *Podo-sclerocarpi*. About 1.5-2 cm. long, and 4-5 mm. high, and 2-3 mm. wide when dry. When fresh the walls about 2 mm. thick, with thin outer skin and soft fleshy substance up to the woody inner wall. Banner oblong and notched, with white spot nearly square and coming within 4 mm. of tip, with sides reflexed a little at base, the blade 1.25 cm. long, gently arched from calyx to 45 degrees, veined. Wings barely arched, linear, concave to keel and flaring beyond, white beyond the keel, rounded, nearly 5 mm. longer than keel. Keel about 1 mm. long, 2 mm. wide at base and 3 mm. at tip, the base straight to tip where it is arched in very short arc to erect, the tip very broadly deltoid. Calyx long-campanulate, nearly 5 mm. long and 3 mm. wide, base straight, upper side arched, oblique at both ends, cleft deeper above, laterally flattened, teeth deltoid and 1 mm. long, tube reddish and ashy. The flowers are about the color of *A. Utahensis*, pinkish-purple except for the white wings, ascending. The pods are very variable in relative length and acuteness as well as amount of compression. Plants ashy when young, densely tufted in a round clump with innumerable slender, sulcate stems erect, not flexuous, about 2 ft. high, with a strong smell of cabbage when bruised. Pedicels stout and ascending. Peduncles at least 1 dm. long. Leaves 5-8 cm. long and narrow. Stipules reflexed above, with nearly subulate tip. Internodes often 1 dm long. Leaflets rudimentary to 2 cm. long, channeled. On the high plains of central Nevada from Contact and Ferguson Springs Nevada to Burbank Utah near Jeff

Davis (Wheeler's) Peak, and probably north through the desert, Growing in strongly salty places in clay, along with *Sarcobatus*. Blooming in May, fruiting in June.

98. *Astragalus Rafaelensis* N. Sp. Pods oblong, nearly round, about 1.5 cm. long and 5-8 mm. wide, abruptly rounded at both ends, with very short and deltoid apiculate beak, the ventral suture conspicuously arched and the dorsal nearly straight, reflexed on stout pedicels, which are 3-5 mm. long and which fully equal the ovate bracts, in long racemes on slender peduncles, splitting through both sutures to the base till the valves fall away. Flowers reflexed early, light-purple or white and tinged with pink, scattered. Banner narrowly ovate, about 2.5 cm. long, with sides inclined to be reflexed which makes it seem linear-oblong, barely notched, the reflexed area about 3 mm. wide at point 3 mm. back of keel but not at all at tip. White spot deltoid, barely colored except for the light-purple veins, 3-5 mm. long. Groove a half circle at keel tip and 1 mm. deep and shallowing quickly, the banner a little hooded at tip, and erect at point 4 mm. beyond the calyx tips. Wings nearly straight, oblong oblanceolate, base 2 mm. wide and 3 mm. wide above, pink at base and white beyond keel and 6 mm. longer, acutish but rounding toward tip. Keel straight, arched to 100 degrees in a sharp arc at the end, deep purple and barely acute. Calyx pink, about as long as wide, barely laterally flattened, straight, smooth, scarcely narrowed at tip and cleft but little deeper there, nerved. Teeth triangular, 2 mm. long. Tube 4 mm. long and 3 mm. wide, hyaline, red. Pedicel inserted about one third the way from the lower corner, about 2 mm. long. Stipules connate nearly to the tip below, nearly distinct above, reflexed, nearly hyaline throughout. Leaves more filiform than usual channeled, of 1-2 pairs of delicate leaflets which are rarely over 1.5 cm. long. The plants grow in very dense tufts with very many stems in a bunch from a woody root, about 2 feet high, straight, in sandy places on sandstone ridges, there being no particular evidence of alkali, though soil is alkaline near Cedar Mt. Utah which is near Woodside, 4500 feet alt. in the Lower Temperate life zone. May 19, 1915. This is an interesting addition to this group and is evidently closely allied to *A. Toanus*.

99. *Astragalus Grayi* Parry Am. Nat. 8 212 (1874). Pods erect to ascending, narrowly-oblong, taper-pointed, not splitting the calyx, about 3 mm. wide, little more than coriaceous, half-exserted from calyx, about like those of *A. Toanus*, its thicker forms but not compressed, the dorsal suture nearly straight and tip the prolongation of it, ventral decidedly arched and pod appearing inverted, not fleshy noticeably. Flowers rather spicate, many, on subterminal peduncles longer than the leaves. Calyx teeth inclined to be subulate. Leaves about 8-10 cm. long. Leaflets 3-4 cm. long, not folded, apiculate, about 4-5 mm. wide, a little wider above, jointed to the rachis, 2-3 pairs. Internodes about 3 cm. long. Green River Desert Wyoming, sandy hills.

100. *Astragalus pectinatus* Douglas in Hook. Fl. Bor. Am. 1 141-2 t 54 (1830). *Tragacantha* Kuntze. *Phaca* Hook. *Ctenophyllum* Rydberg. Pods closely reflexed, oblong-oval to elliptical, rarely nearly globose, obtuse but very strongly apiculate-beaked, rarely triangular-acute and oblong, conspicuously fleshy and with sutures raised at least 1 mm. in the dry pods, splitting the calyx, generally rugose, 1-1.5 cm. long, 9-12 mm. wide, about 4 mm. thick, normally 9 by 7 mm. long and wide, when fresh the pods are transversely oval in cross section and a little sulcate ventrally, the dorsal suture a little raised. Flowers normally rich cream-colored, white below, about 1.3-2 cm. long. Banner arched from 45 to 90°, sides reflexed most above and making it seem taper-pointed, tip very thin and erose, base thick and fleshy. Calyx teeth inclined to deltoid. Bracts stiff, green or scarious, linear-lanceolate

4-6 mm. long, racemes short and on a very short peduncle, clustered among the leaves in fruit. Leaflets 3-10 pairs, not jointed to rachis. From southwestern Kansas on the Plains, to the mountains and northward to the Saskatchewan, westward through northern Colorado to western Wyoming, growing in rather alkaline meadows. Its place is taken in the Navajo Basin by *A. lonchocarpus*. Not on the Pacific slope except in Wyoming.

Astragalus pectinatus var. *platyphyllus* Jones Cont. 10 87 (1902). This is a form with leaflets nearly 5 mm. wide after the style of *A. Grayi* but decurrent on the winged rachis toward the tip of the leaf, some leaflets jointed to the rachis. Bitter Creek Wyoming, Nelson.

101. *Astragalus Casei* Gray Bot. Cal. 1 154 (1876). Pods with cross section oblong to linear when dry, when fresh oval to reniform or even almost that of the figure 8 laid on its side, about 4-5 cm. long, 6-8 mm. wide, 2-5 mm. high, puberulent, bent into the shape of S by the tip being upcurved and the base declined, with sutures narrow externally and prominent, sessile, pendent to horizontal, wider below the middle, splitting the calyx, often shallow-sulcate ventrally and usually so dorsally, rugose when dry, weakly attached to calyx. Flesh variable but never very thick. Flowers not over 2 cm long, nearly sessile, few, at the ends of long peduncles. Banner oblong-ovate, deeply notched, 9 mm. long, abruptly arched to 60 degrees a little beyond the calyx tips, with sides reflexed most in the middle to about 90 degrees to blade and 4 mm. wide there but not at all at tip. Groove U-shaped, 1 mm. wide, 2 mm. deep, very narrow below and broadening into a wide arc at tip of banner. White spot fan-shaped, filling the groove only, cut by wide and purple streaks, coming within 3 mm. of tip of banner. Wings oblanceolate, rounded, entire, concave to keel, both flaring and about 2 mm. apart at tip, purple-streaked at base, white above, 2 mm. longer than keel, not over 2 mm. wide. Keel short, with tip white and purple below, quickly rounded to 90 degrees, obtuse, 3 mm. high, base straight. Calyx oblong to cylindrical, 3-8 mm. long, 2 mm. wide and high, with upper side arched, lower side straight, attached on lower fleshy corner, 5-ribbed by nerves running through from tips of calyx teeth, scarcely flattened laterally or but little. Teeth deltoid to subulate-triangular, 1-2 mm. long. Fruiting pedicels very stout, shorter than the bracts, in flower 1 mm. long. Bracts conspicuous, rigid, often 4 mm. long. Peduncles and rachis 1.5-2 dm. long, loosely flowered on the upper third. Leaflets 2-7 pairs, obtuse. Lower pairs of leaflets of middle leaves about 2.5 cm. long, not over 4 mm. wide, uppermost often very much reduced, mostly 5-9 mm. long, narrowly oblong to linear oblong rigid, distant, usually folded, pubescent on both sides obtuse, petiolulate, jointed to rachis. Rachis of leaf elongated, filiform, 3-10 cm. long. Lower leaves short. Stems 1-2 ft high, widely branched and spreading, very zigzag, pubescence ashy with minute appressed and muricate hairs. Stipules rigid, green, deltoid, reflexed 3-5 mm. long. Rather common in the sagebrush from Pyramid Lake to Death Valley along the eastern side of the Sierras in rather bare spots, eastward to Candelaria, Tonopah and also in the Panamint Mts. Lower Temperate life zone. It has the appearance somewhat of *A. Layneæ* and is easily mistaken for it when the pods have become sulcate dorsally in the drying. It blooms in the early summer.

102. *Astragalus pterocarpus* Watson Bot. King. 71 t 12 (1871). Pods completely obcompressed, winged on the sides only, ovate to elliptical, rather wider below the middle, S-shaped, equally acute at each end, not acuminate, 1 cm. wide, 4 cm. long and 2-3 mm. thick, in the dry pods the cross nerves raised and branched along the margin, tip acute and laterally compressed, cross section linear, very weakly attached to and splitting the calyx, opening at base and apex equally at both sutures and along the ventral suture later, when

fresh grass-green to brownish and becoming reddish, very fleshy with walls about 2 mm. thick, not at all woody and with thin inner skin-like wall, the whole becomes when dry spongily cartilaginous, the dorsal suture is a trifle thickened when fresh, pod then smooth and not at all wrinkled or nerved, thick-winged and wing obtuse, when dry wing is sharp and thin. Flowers pink-purple, about 1 cm. long, 7-9, congested. Banner oval-ovate, retuse, abruptly arched to 45 degrees at end of calyx tube, sides reflexed fully 3 mm. wide from middle up but not turned far back, groove V-shaped, fully 2 mm. deep below, about 1 mm. wide and widening to 3 mm. above, white spot oblong-fan-shaped and purple lined and lacerate above, filling the groove, the rest of banner purple. Wings narrowly oblong, straight, rounded at tip, flaring about equally 2 mm. below tip and then turned nearly horizontal as in *A. amphioxys*, 1 mm. longer than keel, about 2 mm. wide and much narrower than keel, purple, very blunt. Keel short, straight, at tip sharply arched to 90 degrees, very obtuse, purple, 3 mm. high. 5 mm. long. Bracts triangular, green, rigid, conspicuous, shorter than the pedicels. Pedicels stout in fruit, 3-5 mm. long. Peduncles about 1 dm. long, sulcate, rather stout and strict. Fruiting rachis about 5 cm. long. Leaves not over 8 cm. long, almost sessile. Petioles about 1 cm. long, the rachis filiform and persistent and rigid. Leaflets not jointed to rachis, 2-4 pairs, linear, channeled sharply acute, 2.5-4 cm. long, hardly 1 mm. wide, sometimes arched a little, distant, strongly 1-nerved, puberulent on both sides, about as wide as rachis, the terminal one represented by it and not enlarged. Stipules green, closely reflexed, triangular, spreading to reflexed. Stems weak and outer ones ascending only, sulcate, proper stems rarely over 2 dm. long, ashy. This grows along the flats of the Humboldt Nevada, along with salt grass, *Sporobolus* and the like. Lower Temperate life zone. This has the habit and general appearance of *A. pectinatus*, and grows in similar meadows

103. *Astragalus tetrapterus* Gray Proc. Am. Acad. 13 369 (1878). Pods 4-angled, not conspicuously obcompressed, when dry shining and smooth, with fine cross veins sometimes branched in the middle 4-winged by having both sutures raised as wings as well as the sides produced in short wings, with cross section diamond shaped, often oblately so, pod narrowly oblong, inclined to be broader above, the base and tip triangular acute, in the green pods they are only 4-angled, purple spotted, with solid walls fleshy but not woody and 2 mm. thick, internal cavity then inclined to be linear showing that the pod is really obcompressed, pod about 4 cm. long, 1 cm. wide and 5 mm. high, falcate like a ramshorn, not splitting the calyx, the valves when ripe curling out at tip, not more than coriaceous when ripe. Flowers subcapitate 5-9, white or purple, 1.5-2 cm. long, narrow erect, banner oblong (linear as you look at it), 4 mm. wide, 1-1.5 cm. long, arched in gentle arc to 45 to 60 degrees, notched, with pink veins near the keel tip, 5-8 mm. longer than keel, sides most reflexed (to 90 degrees) opposite keel, narrowly fiddle shaped, reflexed part 1 mm. wide, groove narrowly V-shaped and 2 mm. deep below keel and shallowing almost into a nerve at tip. Wings close pressed to keel to within 2 mm. of its tip and then spreading to 2 mm. apart at the ends, concave to keel and parallel to it, 2 mm. wide, with involute edges, about half as wide as keel, linear, obtuse, nearly straight, white or purple, 2 mm. longer than keel. Keel a little downwardly arched and then bent in a half circle to the obtuse tip, pink or purple-tipped, 6 mm. longer than calyx tips. Calyx slightly angled, greenish-white, about 7 mm. long and 2 mm. high, laterally compressed, erect, narrowly oblong, nearly straight, gibbous, the nerves less evident and farther apart than in *pterocarpus*. Teeth subulate, 2 mm. long. Pedicels slender when dry, 4 mm. long, strict, inclined to be 2-bracted near calyx. Bracts very small, barely 2 mm. long, triangular. Pedun-

cles not longer than the leaves, slender, 3-8 cm. long, strict. Leaves 6-8 cm. long, rather close-pressed to stems, the lower the smallest, often very small. Leaflets 7-10 pairs, the upper ones sharply acute, narrowly elliptical to linear, thick, the largest 1-2 cm. long, the smallest often minute and very broad and obtuse, 1-3 mm. wide, inclined to be smooth above, and ashy-white below, the hairs short, wide, close-pressed. Stipules subulate, almost free, reddish. Internodes short and stems therefore leafy, 1-2 ft. long, rather rigid, somewhat sulcate, simple or branched, almost smooth. Plants growing in sandy soil inclined to alkali among junipers and bloom in April and May. Lower Temperate life zone. Cobre Nevada with purple flowers. Fort Hamilton near Kanarra Utah and south to the Grand Canon and Kanab.

Astragalus tetrapterus var. Capricornus N. Var. Flowers purple, about two thirds as long as in the type and petals less elongated, in loose heads. Leaves nearly smooth or equally ashy, inclined to be narrower and shorter, upper leaflets inclined to be narrow and pungently acute. Pods arched mostly into a circle and wings more developed, mostly mottled. Growing in loose soil among the sagebrush at Cobre Nevada, in dense tufts about a foot high from a woody root.

104. **Astragalus sclerocarpus** Gray Proc. Am. Acad. 6 225 (1864). *Phaca podocarpa* Hooker. Pods hoary when young, nearly glabrous when ripe, not mottled, from lunate and about 1 cm. long and triangular acute, to falcate to one third circle, long-pointed and 2.5 cm. long, conspicuously flattened when young throughout laterally, nearly 1 cm. high from tip of suture to suture, in age the body becomes much obcompressed in the middle only and its cross section is oblately oval when dry, it is circular when fresh and without a trace of wings and is green. The stipe is twice the calyx to 2.5 cm. long and falcate, stout. The beak is short and stout or acuminate, upcurved. Pods about the shape of *A. pachypus* but with slender stipe. The flowers are white or tinged with purple and delicate (not thick as in *Gibbsii*), base of petals the more colored. Banner abruptly erect from a point about 3 mm. beyond calyx tube, oval-ovate, the erect part about 7 mm. long, as you look at it the banner is deltoid or short-oblong by the sides being reflexed to the midrib throughout for a space 2 mm. wide or more. Sulcus U-shaped below and shallowing upwards to a mere groove. Wings narrowly oblong, concave to keel, close pressed to it and flaring beyond, arched about 15 degrees gently, narrower than keel, rounded, 5 mm. longer than keel and little shorter than banner, 2 mm. wide. Keel with straight base, the tip shortly arched to 100 degrees, very obtuse, purple. Calyx tube about 5 mm. long, with straight base and upper side arched, cleft deeper above, somewhat narrowed and fleshy below and obliquely attached but stipe in line with base, triangular teeth about 1 mm. long. Peduncles subterminal, 1-1.5 dm. long, stout, racemosely flowered above the middle and elongating in age. Bracts minute. Leaflets 6-9 pairs, broadly linear when flat but mostly folded, 1-1.5 cm. long, weakly attached and soon falling. Petioles about as long as the internodes and shorter than the leaf-rachis, persistent and rather rigid. Stipules ovate-acuminate, very small. Stems rather weak and subdecumbent, freely branched throughout, about 6 dm. long, the upper stems very weak and often aborting, plants soon wilting and not fleshy thickened as in most of the group, inclined to be hoary with minute pubescence, the older leaves less so. In the Columbia Basin only, mostly along the Columbia from Umatilla to the Dalles and north to Ellensburg, near the Malheur river Cusick. It grows on sand dunes.

105. **Astragalus bicristatus** Gray P. A. A. 17 75 (1883). Pods with apex much arched, hamate-incurved, triangular-acute, narrowly oblong, larger above the middle, body about 1-2.5 cm. long; not sulcate,

sides rounded and coarsely net-veined, smooth, mottled; base tapering into a stipe a little longer than the calyx; cross section inclined to be quadrangular to linear when dry, when fresh probably oblate-oval. Ovary glabrous. Flowers 1-1.5 cm. long, white or purple-tinged, blades of petals longer than calyx. Banner oblong-ovate, acutish, gently arched beyond calyx tips to 45 degrees. Wings a trifle longer than keel, narrow, nearly straight, little shorter than banner. Keel blade short, with the abruptly arched erect tip acutish, 5 mm. long, 3 mm. high; claw exerted. Calyx 5 mm. long, campanulate in the type, tube 3 mm. long, cleft deeper above, puberulent; teeth subulate, from a broad base, about one half the tube. Bracts ovate, small. Fruiting pedicels 2 mm. long. Peduncles including rachis often 1 ft. long, stout, floriferous on the upper third. Spikes either short and dense. or elongated and lax at last. Petiole very short. Leaves including rachis 1-1.5 cm. long. Leaflets 7-12 pairs, sometimes acute, 1.5-2 cm. long, nearly linear, flat. Lower stipules not connate. Plants somewhat ashy, rather stout. In gravelly places on the desert side of the San Bernardino Mts. California.

Astragalus bicristatus Var. **tetrapteroides** Jones Cont. 10 59 (1902). Pods a little winged at the sutures; stipe twice the calyx. Flowers in dense heads which scarcely elongate with age. large. Calyx teeth barely one third the tube. Peduncles only a little longer than the leaves. Bear Valley in the same range, hardly a good variety as the pods vary much.

106. **Astragalus Serenoi** (Kuntze) Sheldon Minn. Bot. Stud. 9 130 (1894). *Tragacantha Serenoi* Kuntze Rev. Gen. 2 941 (1891). *A. nudus* Watson, *A. Shockleyi* Jones, *A. oblatus* Sheldon, *A. campylophyllus* Greene. Pods erect or ascending, obliquely oblong-oval, obliquely beaked and inserted, about 2 cm. long, 5-7 mm. high, 1 cm. wide, about half-plum-shaped, with dorsal suture variously intruded and the ventral a little so, with cross-section nearly round. Flowers 6-8, distant. Banner blade about 1.5 cm. long. Pedicels shorter than the bracts, stout, 4 mm. long in fruit. Proper peduncles as long as the leaves. Leaflets 1.5-2.5 cm. long, 1-2 pairs, linear, rather deciduous, with rachis nearly as thick as the stems, stiff and ascending. Stipules ovate-acuminate, deltoid, green-tipped, 1 mm. long. Internodes 5-10 cm. long. This grows in the alkaline valleys of western Nevada from Carson Sink to near Candelaria in large tufts.

107. **Astragalus canonis** Jones Cont 8 15 (1898). This is probably only a form of *A. Serenoi*. Pods obliquely cylindrical, about 2 cm. long, a little obcompressed and arcuate, only a trifle inflated, pseudo-stipitate when dry, with cross section oblate to oval and even retuse ventrally when dry, with dorsal suture intruded about half way, but the sutures do not touch. Fresh pod round in cross-section, smooth, with flesh about 1 mm. thick and transparent and with inner wall more fibrous but cuts easily, when dry the pod is woody and not stipitate, strongly and sharply conical beaked, with each partial cell almost cylindrical. Flowers 2-2.5 cm. long, white to light-purple. Banner oblong-ovate, 1.5 cm. long, pink-purple, deeply notched, gently arched to 80 degrees at calyx tips, with sides reflexed to the groove the reflexed part 2 mm. wide below and the edges nearly touching behind. White spot in banner narrowly oblong, 1 cm. long, filling all the groove, interruptedly purple-veined and going almost to the tip where it shades into purple. Groove in banner (sulcus) U-shaped below but soon disappears 6 mm. below the tip of banner. Petals thin. Wings 6 mm. long, oblong, oblique, notched on the lower side near the tip, fully 2 mm. wide and the obtuse tip a little wider, scarcely arched, purple above, concave to keel and the tips overlapping beyond the keel, not flaring, 3 mm. longer than keel. Keel 3 mm. long and high, abruptly rounded to 90 degrees, with obtusely triangular

tip and 3 mm. shorter than the banner. Calyx from campanulate and 4 mm. long and wide to 9 mm. long and cylindrical, the teeth subulate and as long as tube to only a third as long. Peduncles subterminal. Middle leaves 1-1.3 dm. long and with 2-3 pairs of narrowly elliptical to linear-lanceolate leaflets which are 2-3 cm. long, and 2-7 mm. wide. Lowest leaves 2.5-5 cm. long, with 3 pairs of oval leaflets about 1 cm. long. Uppermost leaves with nearly linear leaflets and all with a white mucro, the uppermost very sharp, all petiolulate. Petioles, peduncles and stems sulcate, barely tapering. Lower stipules hyaline, very wide, 2-5 mm. high, distinct, the upper one striangular, reflexed, 2 mm. long. Internodes about 5-10 cm. long. Stems weakly erect, about 2 ft. high, tufted. Growing where alkali seeps out on slopes in Big Indian Canon west of Hawthorne Nevada.

108. *Astragalus pachypus* Greene Bull. Cal. Acad. 13 157 (1885). Pods 2.5-4 cm. long, 7 mm. high, 2 mm. wide, smooth, much wrinkled when dry, but round and even when fresh, narrowly oblong, with sutures very thick and raised (faint at the short, triangular and sharp tip) and uniting at the base into a solid obconic and thick stipe about 1 cm. long, the tip of pod erect. Seeds short-stalked, flat round 2 mm. wide. Banner about 1.5 cm. long. Wings about 3 mm. wide, arched to 45 degrees and a trifle longer than keel. Keel about 5 mm. long and 4 mm. wide and with the erect and triangular and acutish tip 7 mm. high and purplish. Calyx tube reflexed to horizontal, about 3-5 mm. long, hyaline, nigrescent. Bracts small, broadly ovate, hyaline, 2 mm. long. Pedicels ascending, about 5 mm. long, stout, longer than the bracts. Peduncles stout, scarcely sulcate, 1.5-3 dm. long, longer than the leaves, few-flowered on the upper fourth of their length. Leaves slender. Proper petioles 1-5 cm. long and with the rachis deeply sulcate along the upper side. Leaflets 8-11 pairs, linear, folded, ashy. Stipules connate below, triangular, small. Stems rather stout, rigid, flexuous, with the upper part and young leaves minutely white-pubescent. This grows in loose and rather alkaline soil on slopes at Bealville California, also at Mt. Pinos Venture Co. and by Parish at Cajon Pass.

PREUSSII. 9.

Pods thin-coriaceous to cartilaginous, fleshy except in some *Preussii* forms, inflated, 2-5 cm. long, 1-2 cm. high or or wide, apiculate or shortly beaked, elliptical to round or oblate in cross section, both sutures inclined to be produced within but never 2-celled, in *Preussii* dorsal suture a mere line within, pod mostly stipitate, never deeply sulcate, erect or ascending, rarely reflexed in *sabulosus*, on very stout pedicels, smooth or very minutely and sparsely puberulent when young, obscurely cross-lined, or faintly reticulated, opening nearly to the middle from the tip along both sutures. Flowers large, 2-3 cm. long, widely spreading to reflexed. Petals rather long and long-clawed. Banner arched 45 to 90 degrees near the tip of keel or beyond calyx teeth, oblong-ovate, about 1-1.5 cm. long, with sides much reflexed. Wings narrow, 2-4 mm. longer than keel, obtuse, somewhat arched. Keel base straight, tip mostly gently arched to erect or a little more, rounded, nearly always purple, 3-4 mm. high. Calyx laterally flattened, 5-10 mm. long, about 3 mm. high, cylindrical or not campanulate, teeth mostly short and broad. Bracts hyaline, triangular, not longer than the pedicel which is 2-4 mm. long. Peduncles rigid, stout, erect, tapering, coarsely grooved, mostly as long as leaves. Upper leaves 1-2 dm. long except in *asclepiadoides*, short-petioled, with rigid and tapering rachis, spreading. Leaflets thick and leathery, flat, smooth or never more than puberulent, large, distant, gradually smaller above on rachis. Stipules small for the plant, deltoid, green, reflexed, about 4 mm. (rarely 8 mm.) long. Stems except in forms of *Preussii* thick and stout, 1-3 ft. high. Mostly coarse and tufted perennials little branched, growing in salty or alkaline or very poor clay soil on flats or the equivalent. Pubescence of minute, wide, flat hairs closely appressed and narrowed below and tapering above and attached at or very near the end, mostly absent altogether. This group shows the same remarkable variation in the pods as in *A. gracilentus*, and like it is inclined to have the ventral suture produced a little within, but it lacks the soft and flabby leaves and minutely woolly pubescence and peculiar roughness of leaf surface, and the whole plant has a peculiar leathery succulence, and rigidity, and never grows in sweet soil. Plants blooming in summer. Lower Temperate life zone. rarely in the edge of the Tropical.

KEY

A. Pods conspicuously inflated, not fleshy, coriaceous, nearly erect, abruptly stipitate, opening nearly to the base along both sutures, but a little more freely along the ventral. Flowers ascending. Peduncles axillary. Plants smooth throughout except the calyx.

AB. Leaflets several pairs. Flowers purple. Dorsal suture of pod not noticeably produced within. *Preussii* Proper.

Pods with stipe not longer than calyx.

109 *Preussii*.

Pods with stipe 2 cm. long.

110 *ampullarius*.

Pods sessile.

111 *limatus*

A2B. Leaves represented by a single sessile leaflet which is jointed to the stem, and cordate-oval-ovate, 2-6 cm. wide and 3-7 cm. long. Pods conical-ovate, long-stipitate, capitate on peduncles shorter than the leaflet.

Leaflet one, large.

112 *asclepiadoides*.

2A. Pods somewhat but not conspicuously inflated, cartilaginous, filled with pulp when green, straight or only a little oblique, the ventral suture about straight, both sutures thickened and somewhat intruded. Walls at least 2 mm. thick and fleshy when fresh. Flowers pearl-white, with snake-like or cabbage-like odor, reflexed, many, fully 2 cm. long, spicate. Wings narrow. Keel purple-tipped. Calyx mostly nearly as high as long, short-cylindric, truncate at base and attached on lower corner. Coarse and tufted plants 1-3 ft. high. Leaflets several pairs and large, leathery and flat. *Pattersoni*.

Leaflets linear-lanceolate. Stems 1-2 ft. high.

113 *Pattersoni*.

Leaflets mostly diamond-shaped. Stems low.

114 *sabulosus*.

109. *Astragalus Preussii* Gray Proc. Am. Acad. 6 222 (1864). Pods 1.5-2 cm long, from oval and nearly 1 cm. long, wide and high, to narrowly oblong and 5 mm. high and wide, scarcely to much laterally flattened, when narrow then narrowed below, when large the pods are shortly flat-apiculate, when narrow the pods are triangular-acuminate, dorsal suture sometimes a trifle sulcate and produced as a narrow and very thin edge. Stipe of pod varies from a very thick stalk, hardly as long as wide, to slender and as long as the calyx. The texture of the pod almost chartaceous to thick-coriaceous. Both sutures rather thick and raised externally but the ventral suture not produced within. The pods are straight or a little arched in the narrow forms and erect on a horizontal stipe. The tip of pod is either declined or ascending. Flowers pink-purple-tipped, about 2 cm. long, rarely 1.5 cm. long and smaller, few, and racemose. The banner varies from a little longer than keel to 4-6 mm. longer, it is abruptly arched at end of calyx to 30° and then straight to tip, with sides thin and much reflexed in the middle giving it a triangular outline, with white spot beautifully striped or stipuled. Wings a little longer than keel, obliquely oblanceolate, with triangular and obtuse tip and ascending about 45 degrees much as in *A. amphioxys*. Calyx tube nearly 1 cm. long and 4 mm. wide, with deltoid and fleshy base, about equally inserted, cleft much deeper above. Calyx teeth deltoid and about one-fourth as long as tube in the type. Peduncles 1-1.5 dm. long and about as long as leaves, the floral rachis nearly as long as the peduncle and few-flowered. Leaflets 5-7 pairs and, in the type, obcordate to oval-obovate and notched and rarely 1 cm. long, rather glaucous. Stems a foot or two high, flexuous, ascending, single or few from an erect root, growing in clay or poor sandy soil on benches near rocks. The var. *laxiflorus* Gray Proc. Am. Acad. 13 369 (1878) (var. *laxispicatus* Sheldon) hardly deserves varietal rank. It has subulate calyx lobes 2-3 mm. long. The

species grows from Moab Utah on the Grand river, down the Colorado to Nevada and westward to Amargosa desert California and southward west of the Colorado river to the Mexican line. Most of the Utah forms have congested inflorescence and few flowers.

Astragalus Preussii var. **Eastwoodæ** Jones Cont. 6 368 (1894) as species. **A. Preussii** var. **sulcatus** Jones, Phaca Rydberg. Pods about oval, about 1.5 cm. long and 1 cm. high and wide, straight, abruptly rounded at both ends, very shortly-stipitate, shortly-apiculate-beaked, chartaceous, a little obcompressed, sulcate rather deeply ventrally, and variably sulcate dorsally. Flowers few and short-racemose, as in the type but banner often erect, and keel tip often erect and 4-5 mm. high and triangular. Calyx as in the type, but black-speckled. Peduncles shorter than the leaves. Leaves very narrow, very many, 1-1.5 dm. long, strict with about 10 pairs of linear-lanceolate and very acute leaflets, 7-20 mm. long. Stems cæspitose, decumbent from a thick and woody root, rarely over 2 dm. long, rather slender and with short internodes. Growing on bare rocky ledges or outcrops in deserts, Lower Temperate life zone from Moab and Thompsons Springs and Green River Utah to Monticello. **A. Preussii** var. **latus** Jones (var. **arctus** Sheldon) is a similar form with stipe often nearly as long as calyx and pods not sulcate. Calyx 3 mm. wide and 1 cm. long, the teeth subulate and about one third as long. The leaflets generally elliptical and barely acute, often 7 mm. wide, but varying (as they do in the var. **Eastwoodæ**) from linear to broadly elliptical even on the same plant, the earlier leaflets are broader and the late ones narrower. One would hardly be prepared for such extreme variations in leaflets in the same species, and in habit, but these are manifestly all forms of one species as is shown by similar variations in **A. Pattersoni**, as well as in this species.

110. **Astragalus ampullarius** Watson Am. Nat. 7 4 (1873). Pods ascending, oval-ovate, about 2 cm. long and 1 cm. wide, about round in cross section, conical-beaked and straight, about as in **A. asclepiadoides**, chartaceous, with filiform stipe about 2 cm. long and three times as long as calyx. Flowers purple, the banner nearly 2 cm. long and narrow, much longer than the very obtuse keel. Calyx tube campanulate-cylindric, 4-7 mm. long, a little gibbous, teeth minute. Spikes short, 2-3 cm. long, as long as the petioles, rather dense. Pedicels stout, 2 mm. long in fruit and about as long as the bracts. Leaflets 3-5 pairs, obovate to obcordate-spatulate, 1-1.5 cm. long, smooth above, 7 mm. long, 4 mm. wide. Stipules not connate, hyaline, 2-4 mm. long, broad. Stems short and ascending, hardly six inches long. Pubescence short-strigose and appressed. Near Kanab, Utah. Mrs. Thompson. Not since seen. Lower Temperate life zone.

111. **Astragalus limatus** Sheldon Minn. Bot. Stud. 9 126 (1894). Pods obliquely oval-oblong 2-2.5 cm. long and about 1 cm. high and 8 mm. wide, sessile except for the pseudostipe made by drying of pulp, finely cross-ribbed with linear meshes, the ventral suture about straight or a little convex above and inclined to be shallow-sulcate, Pod abruptly rounded at both ends, shortly beaked or conical-apiculate (the beak nearly in line with the ventral suture), thin and soft when fresh. Flowers as in **A. Preussii**, but short-spicate and many, banner oblong-elliptical, but larger and coarse, nearly 1.5 cm. long, with sides so closely reflexed as to touch each other and making it seem linear, reflexed part 3 mm. wide on each side in the middle; groove deep and narrow, white and with deep-purple veins; white spot goes nearly to tip; blade gently arched to erect from end of teeth. Wings broadly linear, purple, nearly straight, narrowed above the keel, the blade 1 cm. long, 3 mm. wide in the middle and 2 mm. at tip, obtuse and not notched, overlapping each other beyond keel

and 3 mm. longer, concave to it, flaring but not horizontal, 4 mm. shorter than banner. Keel almost exactly that of *A. amphioxys*, the long blade fully 7 mm. long and deep purple, gently arched to erect and very obtuse and rounded. Peduncles 1-2 dm. long, longer than the leaves, very stout and strict. Leaves 1-1.5 dm. long, with 5-8 pairs of elliptical and rounded to notched leaflets 1-2 cm. long. Stems strict, 2 ft. high, often 1 cm thick, with large hyaline stipules. Though close to *A. Preussii* this can be readily separated by the strict coarse stems, spicate flowers, elliptical leaflets, and sessile pods. Sandy soil in washes and alkaline ground. From Canon Diablo Arizona on the Little Colorado westward to the Sierras and southward through the Mojave desert to Mexico, mostly tropical. The forms outside of the Mojave region are not typical but more like *A. Preussii* itself in the leaflets, or with smaller flowers.

112. *Astragalus asclepiadoides* Jones Cont. 4 17 (1893). Jonesiella Rydberg. This is the most unique species in the genus. Pods 3-5 cm. long including the stipe and beak, the body nearly 1.5 cm. wide and high and about 2-3 cm. long, the conical beak 5-10 mm. long and straight, the stipe 1-1.5 cm. long and obconic at tip and nearly 1 mm. thick and straight. Body abruptly rounded to truncate below and abruptly beaked, coriaceous, mostly purple-stippled, from almost exactly conical-ovate to obliquely oval-ovate, mostly a little sulcate ventrally and both sutures a little intruded. Flowers greenish-white, rarely purple tipped, 2 cm. long, narrow, 5-10, about as in *A. Preussii* but narrower and lighter. Banner with sides reflexed about 2 mm. wide opposite keel only; groove U-shaped, nearly 2 mm. deep and 1 mm. wide, extending nearly to tip, waterlined. Wings oblong-linear, bright-pink-purple above 3 mm. longer than keel, about 2 mm. wide, close-pressed to keel about to tip then spreading and tips incurved and horizontal, blunt, nearly straight. Keel about 7 mm. long, the base a little convex and tip erect, triangular and about 3 mm. high. Calyx tube about 8 mm. long, 3 mm. wide and tapering below and arched near the base, nearly equally inserted at the triangular-acute fleshy base, cleft much deeper above, black-speckled, teeth triangular and about 2 mm. long. Leaflet leathery, glaucous, strongly pinnate-veined, barely acute, appearing as if clasping but on a petiole about 2 mm. long which is flanked by the hyaline, deltoid to circular 5-7 mm. long stipules like wings. Stems stout, nearly erect, little branched, few from the tip of the rather fleshy and erect root. Internodes shorter than the leaflets which are overlapping and appressed. Common in the poorest adobe soil from the Uinta Mts. to the Henry Mts. and throughout the Navajo Basin from Price to Grand Junction. Also on the clay bad lands at Gunnison Utah in Sevier Valley. This does not grow where alkali stands but often there is alkali all round it in a white efflorescence, but it never grows in any but compact soil, and it grows where not even *Sarcobatus* will exist.

113. *Astragalus Pattersoni* Gray in Brandegees Rep. S. W. Colo. 285 (1876). *Phacopsis* Rydberg. *A. diphyus* var. *albiflorus* Gray, *A. recedens* Greene. This is also a very variable species, the pods in the type are about 2 cm. long, 8 mm. wide and 5 mm. high, straight, oblong, a little oblique, the ventral suture about straight and the flat-tish subulate beak 4-6 mm. long and nearly in line with it, pods rounded at base, faintly cross-ribbed and low reticulated, with a tendency to be contracted in the middle, on very stout pedicels 2-3 mm. long, erect, inclined to be a little sulcate at both sutures, but the sutures raised and thick externally. Leaves drying yellowish. Banner oblong-ovate, about 1 cm. long, arched in gentle arc to erect beyond calyx, sides much reflexed and so seemingly very narrow. Wings about 1 mm. wide, 2-3 mm. longer than keel and about straight. Keel about 4 mm. long and high, with abruptly erect tip triangular, with exsert-

ed claw. Calyx tube about 5 mm. long and 4 mm. high, or a little longer and narrower, quite oblique at tip and base, the upper side arched and the lower straight, almost white, very thin, the subulate teeth from a broad base about half as long as tube. Bracts triangular, hyaline, shorter than the rather slender pedicels which are 2-4 mm. long. Spikes 1-3 dm. long. Peduncles often a foot long, in the middle axils, strict. Leaves about 2 dm. long, nearly sessile, ascending, with 10-12 pairs of linear-lanceolate leaflets about 2 cm. long, and placed on the upper side of the rachis. Stipules large, green, reflexed, about 1 cm. long, acuminate. This is the type but the leaflets vary to broadly elliptical and retuse and 1 cm. long. Stems from 1-3 ft. long, either strict or decumbent and branched below. From the Sevier valley Utah at Salina to Verde Arizona, throughout the Navajo Basin and over in the Rio Grande valley of New Mexico as far as Mesilla Park, extending a little into the Tropical, in poor clay soil. Forms of this occur with a pseudostipe 2 mm. long caused by the drying of the pulp.

Astragalus Pattersoni var. praelongus (Sheldon Minn. Bot. Stud. 9 23 (1894) as species) Jones Cont. 10 65 (1902). *A. procerus* Gray, *A. Rothrockii* Sheldon. This is a form with oval pods plum-like and about 1.5 cm. long. Flowers stubby, with broad banner and wings seldom much longer than keel, with calyx teeth deltoid and 4 times shorter than the tube, with peduncles much shorter than the leaves and subterminal, and with oval to oval-ovate leaflets 1-2 cm. long and very glaucous. The extreme form seems very distinct but it intergrades in every particular. In the Virgin valley around alkaline seeps and westward to the Charleston Mts. Tropical. Forms intergrading variously are found all the way from the Staked Plains of Texas through the Rio Grande valley and the Little Colorado and the Navajo Basin, but true *procerus* seems to be found only in the restricted area. A form referred to *A. Rothrockii* from Wooton is an intergrade.

114. **Astragalus sabulosus** Jones Cont. 2 239 (1891). Pods 3-5 cm. long and about 1.5 cm wide and high, oblong, straight, barely oblique, the stout triangular flattish beak straight, about 2-3 mm. long and a little above the middle of the end, the base shortly triangular. pod finely cross-lined and a little reticulated, reflexed and mostly pendent, ashy with minute hairs fixed by the base; surface uniform but little sulcate or grooved ventrally, dorsal suture not evidently or slightly intruded, nearly round in cross section, a little inflated and walls thinner than in *Pattersoni*. Flower 4-8 on a rachis hardly 2 cm. long, almost capitate, about 2.5 cm. long. Banner elliptical, about 1.5 cm. long, arched abruptly at end of teeth to 45°, with sides much reflexed, nearly 1 cm. longer than keel. Wings about 2 mm. longer than keel and much narrower. Keel nearly 1 cm. long, straight, at tip abruptly erect or nearly so and 4-5 mm. high, the tip triangular but very obtuse and rounded, dark. Calyx tube 1 cm. long, 6 mm. high, oblique at both ends, by being cleft deeper above and by the truncate base a little saccate above, inserted a trifle below the middle on a very stout hairy pedicel 2-3 mm. long, brownish-nigrescent with close pressed hairs. Calyx teeth deltoid about 2 mm. long. Hyaline bracts ovate and about 3 mm. long. Stipules deltoid to triangular, coarse, thick and spreading, about 5 mm. long. Peduncles very stout, about 2 mm. thick, and 5 cm. long, shorter than the leaves, in the middle axils. Leaves in flowering time rarely 1 dm. long, later ones often a foot long, conspicuously petioled, the petiole much longer than rachis when leaflets are few, when with several pairs of leaflets it is often shorter than rachis. Leaflets on the upper side of the rachis, rarely single but mostly 1-3 pairs in the young leaves or 5-6 pairs in the late ones, about ovate-diamond-shaped or obovate or even lanceolate,

always apiculate and mostly acute, those of the lowest leaves often elliptical and 1 cm. long, the upper and latest leaves having leaflets 5 cm. long and 3 cm. wide, minutely ashy with the same peculiar appressed pubescence. Stems rarely a foot long, ascending, very stout and with short internodes and many leaves, flexuous or zigzag, woody and from a thick woody root. On barren clay slopes on the Grand River near Cisco Utah and the La Sal Mts. Lower Temperate life zone. The flowers are the coarsest in the genus in America and the largest but not the longest. The outer stems often nearly flat on the ground.

REVENTI-ARRECTI. 10.

Pods with dorsal suture variously intruded but rarely touching the ventral, with texture cartilaginous and decidedly fleshy to simply chartaceous, somewhat inflated, about straight (arcuate in the *A. vallaris* section), rarely a little arcuate, with declined tip (except in *A. accidens*), stipitate, rarely nearly sessile, firmly attached to stipe and calyx and not separating from them, narrowly ovate to linear, or oval erect though the calyx is rarely reflexed, (a little reflexed in *A. vallaris* and *accidens*) mostly acute at both ends, nearly smooth when mature, 1-6 cm. long, cross-ribbed or corrugated, sulcate dorsally, opening first at tip along both sutures, with cross-section deltoid to triangular-cordate or nearly round, with ventral suture raised, thick or very thick, prominent, convex toward the tip of pod and mostly so at base, pod never sulcate ventrally except in *A. vallaris* and *Bolanderi*, 1-celled at tip and flat-beaked, racemose, (spicate in *A. Bolanderi*). Flowers rather many, ascending, mostly white or purple-tipped, about 8-20 mm. long. Calyx short-cylindric or rarely campanulate, with teeth rarely half as long as tube, nigrescent, tube hyaline, inserted on the lower corner and with the upper corner rounded to it and convex and the lower side straight, the mouth oblique and cleft deeper above. Pedicels rather stout, as long or twice as long as the small and rather deciduous bracts. Peduncles sulcate, less pubescent than the leaves, strict, mostly long. Leaves long and narrow. Leaflets many, rather long-petiolulate, 1-2 cm. long, the lower not opposite, gradually smaller toward the tip of the tapering rachis. Stipules mostly rather large, hyaline, not connate below (for the most part), often imbricated. Proper stems with few nodes except in the *A. vallaris* group, inclined to be short and erect, terminated by the mostly long peduncles (but peduncles axillary in the *accidens* and *vallaris* groups), nearly smooth, many in tufts from the rather woody root. Pubescence of flat and mostly wide hairs fixed by the base and at right angles to the junction and so closely appressed, rarely tangled and somewhat woolly, mostly sparse.

KEY

- A.** Pods sessile, or on a very thick pseudostipe made by the shrinking of the flesh when dry. appressed and erect, barely inflated, nearly 2 cm. long, 4-7 mm. wide, 4-5 mm. high, rather fleshy. cartilaginous and wrinkled, splitting the calyx, shallow-sulcate or almost flat on the back (dorsal side), almost wholly 1-celled, the dorsal suture a mere ridge within or slightly raised, somewhat

raised externally also. with tip not conspicuously declined. Flowers rather spicate, 1.5-2 cm. long, white or nearly so. Calyx cylindrical, 5-8 mm. long, nigrescent. Banner oblong ovate 7-15 mm. long, arched rather abruptly beyond calyx tips to 45 to 90 degrees, much longer than keel. sides reflexed 2 mm. wide below. Wings about straight, 2 mm. wide, longer than keel. Fruiting peduncles nearly as thick as stems, coarsely sulcate. Leaves narrow, with petiole shorter than rachis. Leaflets elliptical to linear. not over 2.5 cm. long, separated about half their length. Stems coarsely sulcate, bent at the nodes which are few and mostly congested near the root except in *A. adanus*. densely tufted and sparsely pubescent except when young, the whole 1-2 ft. high. Stipules hyaline, inclined to be connate below, broad and rather short. Reventi.

Proper stems almost none.

115 reventus.

Stems 1-2 ft. high.

116 adanus.

2A. Pods stipitate. coriaceous to papery, evidently inflated, finely cross-ribbed. Plants with conspicuous stems except in forms of *A. arrectus*. Flowers racemose, rather ascending. Leaflets 5-10 pairs.

2AB. Pods coriaceous to papery. nearly linear to oblong, 2-3 cm. long, including stipe, with triangular-cordate cross section, abruptly contracted at tip into the flat beak which is nearly in line with the dorsal suture, nearly straight and erect, the calyx often recurved. Flowers 1-1.5 cm. long. Arrecti.

Stems slender, with several nodes.

117 arrectus.

2A2B. Pods smooth, cartilaginous to coriaceous, 2-7 cm. long, almost 2-celled, conspicuously sulcate at both sutures, much ob-compressed and arcuate, long-stipitate on a recurved pedicel and with tips erect, and long-acuminate-triangular, on axillary peduncles about 1 dm. long, shorter than the leaves, few, rather capitate in flower. Leaves about 1 dm. long, almost sessile. with about 10 pairs of broadly to narrowly elliptical leaflets 1-2 cm. long and rounded to retuse and nearly contiguous. Stems weakly ascending, 1-2 ft. long, with rather many nodes and slender internodes, tufted from rather woody roots. Flowers probably white. about 2 cm. long. Calyx cylindrical. 5-7 mm. long, the teeth shorter than the tube, on short and stout pedicels. Stems decumbent, slender, 1-2 ft. high, from the woody crown. Vallares.

Flowers 2 cm. long. Pods 2 cm. long or more.

Stems coarse and low, with few nodes. Pods 2 cm. long. 118 Cimæ.

Stems slender, with many nodes. Pods 4-5 cm. long. 119 vallaris.

Flowers and pods 1 cm. long.

120 Bolanderi.

2A3B. Pods wholly 2-celled by sutures being united and forming a double partition which splits through when old forming two separate cells, but a plum like fleshy fruit when ripe, which is generally sulcate at one or both sutures, on slender stipes at least as long as the calyx. oblique but little if at all arcuate, abruptly rounded at tip, with very short and stout not flat up-curved beak inserted above the middle of the end, laterally compressed when dry, reflexed or indifferently spreading, ventral suture rather prominent, stipes about 7 mm. long. Flowers white, about 1.5 cm. long, rather narrow, widely spreading or reflexed when old. Banner ascending in gentle arc to 45 degrees beyond calyx tips, oblong-oval. Wings straight, about 3 mm. longer than keel, 2 mm. wide. Keel straight, with tip abruptly bent to erect, about 3 mm. long and high, often dark-tipped or not. Calyx nearly equaled by the teeth which are subulate. Tube campanulate to cylindric. Bracts about 2 mm. long, sub-

late, hyaline, as long as the pedicels. Peduncles barely as long as leaves, sulcate and slender. Leaves many and narrow, about 1 dm. long. Leaflets nearly contiguous, flat, thin, 6-15 pairs, cuneate at base, long-petiolulate, broadly to narrowly elliptical, 1-2 cm. long, rounded, sparsely and softly hairy. Stems very slender, sulcate, with rather long internodes, weakly ascending, 2-3 ft. long, smooth. Pubescence fine, lax and soft, kinky, attached by the enlarged base. Plants of moist and sweet forests of the Siskiyou region of northern California and adjacent Oregon. Middle Temperate life zone. Pruniformes.

Pods plum-shaped, on a slender stipe.

121 accidens.

115. *Astragalus reventus* Gray Proc. Am. Acad. 15 46 (1879) *A. reventus* var. *Canbyi* Jones. *Phaca reventa* (Gray) Piper. Pods 1.5-2 cm. long, oblong-ovate to lanceolate, about 5 cm. wide and 4 mm. high, fleshy and with woody inner walls, the sutures very prominent and raised, barely sulcate and with nearly round cross section and dorsal suture a mere ridge within, shortly acuminate into flattish beak 2-4 mm. long. Flowers soon reflexed, white. Banner deeply notched, about 1.5 cm. long. Wings lanceolate, about 4 mm. longer than keel and as much shorter than banner or less, rounded. Keel straight, tip abruptly erect, triangular and acutish, 3 mm. high. Calyx tube convex on the upper side, teeth usually filiform, from half to nearly as long as tube. Pedicels shorter than bracts, stout, about 2 mm. long, erect. Bracts lanceolate, hyaline. Peduncles coarse, nearly a foot long and subscapose, floral spikes mostly short-oblong and many flowered. Leaves 1-2 dm. long, with 10-20 pairs of elliptical leaflets hardly 2 cm. long which are rounded, thin, and nearly smooth above, folded when young and seemingly linear, ashy, short-cuneate at the long petiolulate base. Mature stems with 1-2 internodes 2-6 cm. long, from woody root. Pubescence minute. Stony hills of the Blue Mountains Oregon to Yakima valley and the Palouse, Washington. Middle Temperate life zone.

Astragalus reventus var. *conjunctus* (Watson) Jones Cont. 10 61 (1902) *A. conjunctus* Watson Proc. Am. Acad. 18 371 (1882). *A. conjunctus* var. *Hoodianus* (Howell) Jones, and var. *oxtropidoides* Jones. *Phaca conjuncta* (Watson) Piper. This differs from the type in having the flowers rather racemose, the calyx lobes rarely over one third the tube, the pod being distinctly inflated and 2-3 cm. long, with the dorsal suture a little intruded, and the walls coriaceous, and in the linear leaflets. The var. *Hoodianus* is intermediate with a cartilaginous pod and elliptical leaflets. All sorts of intergrades occur. Throughout the Columbia Basin. Middle and upper part of lower Temperate life zone in rocky open places. The flowers are often tinged with purple.

116. *Astragalus adanus* Nelson Bot. Gaz. 53 222 (1912). Pods nearly oval, about 1 cm. long, 5-7 mm. wide and 3 mm. high, shallow-sulcate ventrally, flattish dorsally and obcompressed, very abruptly acute by a deltoid and flattish beak which is in line with the ventral suture and is long-subulate pointed, pod thin-cartilaginous, the wall when fresh about 1 mm. thick, finely cross-ribbed, the shape nearly that of *A. gracilis*, dorsal suture merely raised within, a little inflated. Flowers not known. Peduncles subterminal, shorter than the leaves. Leaves 1-2 dm. long, with 7-15 pairs of elliptical rounded leaflets hardly 1 cm. long. Stems a foot or two high, with 3-4 internodes 5-7 cm. long. Whole plant nearly smooth. Steep north hillsides at Boise Idaho, McBride. On the edge of the Lower Temperate life zone. This was described as a near relative of *A. nudus* but its affinities are all with the Reventi.

117. *Astragalus arrectus* Gray Proc. Am. Acad. 8 289 (1870) *A. leucophyllus* Hooker, *atropubescens* C. and F., *A. Palousensis* Piper, *A. Cusickii* Rydberg not Gray, *A. Malheurensis* Heller, *Phaca* Piper. This is a very variable species and the type will be described first. Pods nearly linear, appressed, about 2 cm. long and 3 mm. wide, coriaceous, smooth, acute at both ends, the ventral suture straight or a little concave in the middle but much humped at the end, raised as a heavy line throughout, dorsal suture variously intruded as a thin partition, and pod deeply sulcate. Stipe hardly as long as calyx and straight. Flowers white, or ochroleucous, about 1.5 cm. long. Banner fleshy at base and very stubby, oval, the erect part a mere margin about 1-2 mm. wide, about as long as keel and decidedly shorter than the wings. Wings rather broadly oblong, notched, straight, 2-4 mm. longer than keel, about 2 mm. wide. Keel about half a circle 3 mm. high and long, the tip acute and a little more than erect, not colored. All the petals with exerted claws. Calyx campanulate and narrower below, rather obliquely inserted on a stout and very short pedicel, oblique at mouth and deeper cleft above, nigrescent (especially on the teeth) with appressed short hairs, teeth nearly deltoid and nearly half as long as tube. Bracts minute, longer than the pedicels, triangular-ovate. Peduncles about a foot long, strict, the floral rachis in fruit 1-2 dm. long, almost as stout as stems. Leaves 1-2 dm. long, the upper nearly sessile, with 6-15 pairs of nearly linear to broadly elliptical, retuse leaflets cuneate below, which are ashy below with short and tangled hairs and rarely 2 cm. long. The young leaflets are mostly linear and dark, the mature leaflets are often ovate-elliptical and green, especially on the upper leaves which are the largest. Stems often a foot high and with several slender internodes, from woody roots. This is exactly *A. Palousensis* Piper. It is common in the Columbia Basin, Middle Temperate life zone on prairies. *A. atropubescens* C. and F. nearly smooth forms with zigzag stems, oblong leaflets, leaves often a foot long, pedicels longer than the bracts and with the calyx horizontal, and a curved stipe a little longer than calyx bringing the erect pod within half its length of the rachis, the banner is produced and triangular-ovate, erect and 2-4 mm. longer than the keel. This form abounds on the headwaters of the Missoula in Deer Lodge valley and vicinity. *A. Cusickii* Rydberg *A. Malheurensis* Heller is near the var. *Kelseyi* but with linear leaflets and its long stipe. This abounds in the Snake River valley from Glens Ferry west, though most of the forms are referable to the variety.

Astragalus arrectus var. *Leibergi* Jones Cont. 7 663 (1895) as species, and 10 68 (1902). *Phaca arrecta* var. *Leibergi* (Jones) Piper. This is a form with narrowly linear to almost filiform ashy leaflets, scapose peduncles a foot long and with rachis a half more, with typical pods, and with leaves nearly a foot long all clustered at the root which is a mass of knotty crowns. This is a striking form but not a good species. Egbert Spring's Douglas Co. Wash. Leiberg.

Astragalus arrectus var. *Kelseyi* (Rydberg Fl. Mont. 241 1900 as species) *A. eremiticus* var. *Spencianus* Jones *A. Boiseanus* Nelson. This has nearly straight stems a foot or two long, leaflets ovate-oblong to oblong, rather glaucous, about 10 pairs, stem leaves with very short petioles, peduncles in the axils of the upper leaves and shorter than they, with rather few pods near the ends, flowers white or purplish and keel generally purple tipped with the banner elongated as in *atropubescens*, calyx tube 1 mm. long, cylindrical and the teeth hardly a fourth as long, the flowers horizontal and calyx reflexed more or less in fruit, the pod being erect on a long and tapering stipe about half as long as body which 2-3 cm. long. This is the common form on the dry juniper benches of Nevada from Battle Mountain to the Utah line and

over on the Snake river valley where it grows in sagebrush plains. Lower Temperate life zone. The pod is often mottled or reddish. The leaflets are sometimes 3 cm. long but with the ovate or lanceolate base and oblong outline above and mostly notched. Whole plant nearly smooth. It is not likely that it extends south of Osceola Nevada nor is it known at all in Utah.

Astragalus arrectus var. eremiticus (Sheldon) Jones Cont. 7 665 (1895). *A. eremiticus* Sheldon Minn. Bot. Stud. 9 161 (1894). This is the form the species assumes in the hot regions adjoining the Tropical life zone at the south. Pods about 1.5 cm. long, oval-oblong, to oblong, chartaceous, conspicuously inflated, on a tapering stipe about as long as body and erect or nearly as in the preceding variety, the dorsal suture a little intruded. Calyx cylindrical and as in the last variety. Flowers in long racemes and about 1.5 cm. long, white, ochroleucous or purple, the banner not fleshy, oval-ovate, with sides much reflexed throughout and seemingly triangular, claws little exerted. Wings truncate to notched and broad as in the type, the tips always white or yellowish when flowers are purple, keel a little longer than high and with rounded tip and purple-tipped. Pedicels longer than the bracts, in fruit 2-4 mm. long as in the var. above. Peduncles 1-3 dm. long, mostly longer than the leaves, slender but stout for the plant. Leaves a foot or less long, the upper nearly sessile, with about 10 pairs of elliptical-lanceolate leaflets which are glaucous, conspicuously petiolulate, distant and 1-2 cm. long and rounded, rarely notched, thin. Stipules large, broad, green-striped. Stems often a foot long, zigzag, slender, from a woody and branched base. Common from the Beaverdam Mountains near St. George Utah to Chloride Arizona in the Lower Temperate life zone on the edge of the Tropical on gravelly mesas and among rocks. A form of this at Chloride has oval pods on a stipe hardly longer than the calyx, rudimentary calyx lobes and purple flowers with conspicuous white or yellowish wings, and nearly oval and half shorter leaflets.

Astragalus arrectus var. remotus n. var. This is a striking form with the racemose flowers and fruit rather closely appressed. Pods narrowly oblong to linear, about 1.5 cm long and 3-4 mm. wide, abruptly apiculate at tip, purple-nerved, thin, triangular-acute at base, on a stipe barely as long as the calyx, with cross-section reniform-triangular. The pods have the dorsal suture produced almost to the ventral as a hyaline partition and are chartaceous, but little inflated and smooth as in the other forms, the ventral suture is a broad and purple stripe externally. Calyx oblong-campanulate, laterally flattened, 2 mm. high, 1 mm. wide, nigrescent, deeper cleft above with broad sinuses, about 3 mm. long and much as in the type species. The calyx teeth are variable but about half as long as tube, triangular and green. Pedicels as in the variety *eremiticus* but 8-9 mm. long, the deltoid-ovate banner about 7-8 mm. long and abruptly arched to 45 degrees just beyond calyx tips, and thin. Groove in banner shallow, less than a half circle, 2 mm. wide and faintly veined, stopping 2 mm. from tip of banner. Wings flat to keel, oblong-ovate, rounded, entire, concave, the right hand one flaring, both arched to 45 degrees, 2 mm. wide at tip, longer than keel, obtuse to erose, often speckled. Keel very obtuse, with straight base, tip erect and purple. Bracts conspicuous but small, about as long as flowering pedicels which are short. Peduncles wiry, 1-2 dm. long and strict, a little longer than the rachis. Leaves rarely 1 dm. long, all petioled, ashy, with 6-8 pairs of small leaflets 5-15 mm. long, which are mostly folded and seem linear but are narrowly to broadly elliptical, thick and obtuse and distant. Stems in dense tufts, slender, with 2-3 long internodes 5-7 cm. long and zigzag, from woody base. Growing among rocks at Good Springs on the western edge of Nevada on the lower edge of the Lower Temperate

life zone. This is the extreme variation of the species caused by aridity and hot climate. But all these forms intergrade from one to the other as you go south.

Astragalus arrectus var. scaphoides Jones Cont. 7 664 (1895). *A. scaphoides* Jones *A. scophioides* Rydberg. This is a form with the coriaceous pods truncate below, oblong, about 2 cm. long and 1 cm. wide and 3 mm. high, much obcompressed and rather sulcate at both sutures, the dorsal suture intruded nearly to the ventral as a thick partition. Stipe stout and about half as long as pod. Calyx tube short-cylindrical, about 4 mm. long and the teeth a fourth as long. Peduncles about a foot long and racemosely flowered. Leaves about 1.5 dm. long. Leaflets about 10 pairs, elliptical, smooth above. Stems very coarse and stiff, about 2 ft. high. Clark's Canon, Beaver Head Co. Montana. Middle Temperate life zone. This is known only from one specimen and may be only a robust form of the var. *Kelseyi*. Forms from Weiser Idaho connect this with the type.

118. **Astragalus Cimæ** N. Sp. Low and rather coarse. The proper stems rarely 1 dm. long, with short internodes, large and hyaline stipules and long lanceolate bracts and few flowers in a head and shortly racemose pods in fruit and on peduncles shorter than the leaves. Tufted stems from a woody root and zigzag and decumbent. Leaves almost sessile, about 1 dm. long, of about 10 pairs of oval-obovate and slender-petiolulate leaflets, 1 cm. long which are rounded or retuse, and smooth and flat and leathery. Flowers not seen but evidently large and ascending. Pods very fleshy, probably 2 mm. thick when fresh, finely cross-veined and wrinkled, much arcuate and with deflexed tip, stout and triangular with ventral suture concave except at the very convex tip, much laterally flattened and broadly sulcate at both sutures and with rounded sides, about 2 cm. long, 1 cm. wide and 5 mm. thick, the body often arched in a half circle and set at right angles to the stout stipe which is 1 cm. long, narrowly oblong to ovate, splitting through the ventral suture to stipe, the dorsal opening at tip and to the middle at least, somewhat inflated but apparently full of pulp. Both sutures intruded and the dorsal nearly to the other in the middle of the pod but not at all at the ends. The ventral suture very thick and somewhat raised when dry, the dorsal thin and raised. Cross section oblong. Collected by Mrs. Brandegee at Cima on the edge of Nevada near the Charleston Mts. 1915. This reminds one of a *Bolanderi*.

119 **Astragalus vallis** Jones Cont. 10 59 1902) Pods with body 4-5 cm. long, 1 cm. wide, and 5 mm. high, either abruptly acuminate or truncate at base, finely reticulated and cross-nerved, arched to about a third circle, oblong-ovate, with cartilaginous walls about 2 mm. thick when fresh, with stipe 2 cm. long, the base of pod ending in a very thick obconic beak-like straight stipe tapering into the calyx which being a little reflexed brings the body of the pod about horizontal and the tip nearly erect, general outline of pod lanceolate-oblong with tip flattened and 2-3 times as long as wide and only slightly declined. Flowers white, about 2 cm. long. Banner gently arched to 45 degrees 2 mm. beyond the calyx tips, lanceolate, with sides reflexed 1 mm. wide above the middle and making the blade seem very narrow above. The wings are linear, 2 mm. wide, fully 2 mm. longer than keel, narrowed at tip, a little ascending. Keel gently rounded from the base to the erect tip which is blunt, 7 mm. long, purple, about as in *A. amphioxys*. Calyx about 5 mm. long, obliquely inserted, with subulate teeth about as long as tube. Fruiting pedicels very stout, about 3 mm. long, ascending. Peduncles in the lower axils only, as in *A. crassicarpus*, slender, hardly 1 dm. long, with the few pods short-spicate on a rachis hardly half the peduncle. Bracts and stipules small and acuminate. Leaflets with a shortly-cuneate base, contiguous, at least a third as wide as long, with the proper petiole hardly half as long as the adjoining leaflet, and the leaf rachis tapering, green-striped and widely

spreading, leaflets thin and inclined to be notched at the end, bright-green and apparently smooth, under a lens the young parts are sparsely ciliate or appressed-hairy. Internodes very many, with the upper ones often as short as the leaflets, and so the leaves are congested above. Whole plant nearly smooth except the nigrescent calyx. Found in Snake River canon near Ballard's Landing and on Pine Cr., and on the grade below Cuprum, Idaho, on rocky slopes, Middle Temperate life zone. First collected by Cusick in 1898, then by myself (pods only) in 1899. This species reminds one, as to habit, of *A. crassicarpus*, *accidens*, and *Beckwithii*, but its relationship is here, and *accidens*, though less related, can hardly be placed elsewhere.

120 *Astragalus Bolanderi* Gray Proc. Am. Acad. 7 337 (1868) *A. supervacaneus* Greene. Pods with body about 1 cm. long (the slender stipe 4 mm. long), about 5-7 mm. wide and 5 mm. high, thin-coriaceous to almost chartaceous, oblong-lanceolate, evidently inflated, cordate at base, shortly triangular-acute at the flat tip (which is as high as long and evidently declined only when young), indistinctly cross-nerved and but little reticulated, arched to a half circle or more and inserted at right angles to the stipe: partition intruded to the ventral suture from base to middle of pod: cross-section about ∞ -shaped. Flowers white or cream-colored, with rather short claws, about 1 cm. long, ascending and almost capitate, rather few, sometimes tinged with purple. Banner ovate, gently arched to nearly erect about 2 mm. beyond calyx tips, 4-6 mm. long, inclined to be stubby and short, 2-4 mm. longer than the keel, with sides reflexed about 1 mm. wide below. Wings nearly linear, straight, fully 2 mm. longer than keel. Keel straight, about 4 mm long, with erect tip which is abruptly arched, 3 mm. high, triangular, and slightly if at all colored, long-clawed. Calyx ashy, about 5 mm. long, cylindrical but a little narrower below, rounded at base and somewhat obliquely inserted, straight, with slender and subulate teeth unequal and a little shorter than the tube. Peduncles in the upper axils only. Pedicels as long as the ovate bracts. Leaves about 1 dm. long, ascending. Leaflets distant, linear-lanceolate, ashy with fine, crisped and woolly appressed hairs. Internodes 4-5, 2-5 cm. long, not shorter above. It grows in poor, gravelly and rocky soil, in the higher Sierras from King's River north nearly to Shasta in the Upper Temperate life zone.

121 *Astragalus accidens* Watson Proc. Am. Acad. 22 471 (1887). Pods half-oval to almost lunate, also half-oval to half-round longitudinally, and broadly elliptical in cross-section, shortly-acute at both ends, little pulpy, a trifle inflated, nearly smooth but ovary white-pubescent, sometimes sulcate dorsally, finely reticulated, 7-12 mm. long, 5-7 mm. high, mostly horizontal: cross-section ovate to elliptical but sometimes nearly round: only the ventral suture raised and thick externally and straight to concave. Flowers reflexed. Banner narrow, erect, 1-1.5 cm. long, ascending beyond calyx tips to 45 degrees, with sides reflexed. Wings oblong, 3 mm. longer than keel, 1 mm. wide. Calyx reflexed, campanulate, 7 mm. long. Bracts 1 mm. long, equal to the pedicels. Peduncles 1-1.5 dm. long. Racemes short. Leaf rachis 8-15 cm. long. Leaflets 10-15 pairs, truncate to retuse, 1-1.8 cm. long, appressed-pubescent below and glabrous above. Plants sparingly pubescent except the ashy pods. This grows in open woods, Oregon. Cow Creek, Howell. Glendale, Jones.

Astragalus accidens* var *Hendersoni (Watson Proc. Am. Acad. 22 471 1887 as species). *A. Watsoni* and *Pacificus* Sheldon. *A. cymatodes* Greene. *A. pruniformis* Jones. Pods smooth, obtuse at both ends, very fleshy, a trifle oblique, 8-23 mm. long, 7 mm. wide. 9 mm. high, rather deeply reticulated when dry, indifferently spreading to reflexed, not inflated, from nearly oval to oblong-oval, apiculate, with both sutures raised, the ventral nearly 1 mm. thick and the dorsal thin. Flowers with the oval banner 6 mm. longer than keel and sides reflexed 3 mm. wide below. Wings nearly oblong. Calyx tubular-campan-

plate, nigrescent, 7-9 mm. long, with narrow teeth as long as tube. Bracts triangular, longer than the flowering pedicels and as long as the fruiting ones and 2-3 mm. long. Pedicels stout. Peduncles 9-15 cm. long in fruit, longer than the leaves, few-flowered, flowering on the upper third. Leaves 7-10 cm. long. Leaflets 6-14 pairs, usually 10, 1.5-2.3 dm. long, 5 mm. wide, rounded to obtuse, narrowly cuneate-oblong. Stipules lanceolate, 2-7 mm. long, green. Internodes 2.5-6 cm. long. Stems numerous, erect to ascending, 1-2 ft. high. Root woody and stout. Pubescence softly and sparsely appressed woolly-villous. This grows in identically the same locations as the type and differs only in the cuneate leaflets and thicker pods. The general shape of the pods is the same as *A. macrocarpus* of the Old World.

11 ULIGINOSI.

Pods fleshy when green and cartilaginous when dry, barely or nearly 2-celled by the intrusion of the dorsal suture as a thin partition (except at the tip where it is 1-celled), sessile, cross-ribbed, oval to narrowly oblong, rounded at base, sulcate dorsally, with ventral suture thick and raised externally and convex; when pod is straight (except perhaps in *A. terminalis*), with cross-section round to reniform, with declined tip not evidently flattened and forming either an abrupt point or a strong subulate beak and the pod being abruptly pointed, 1.5 to 2 cm. long, with the hard walls barely 1 mm. thick when green. Flowers greenish-white (purplish in *A. terminalis*), stubby, about 1 cm. long, spicate, reflexed (but pods not). Calyx short-cylindric, with teeth not half the tube. Bracts and stipules triangular-acuminate and mostly rather long. Leaflets many pairs, hardly contiguous. Upper petioles rarely twice as long as the lowest leaflet, the lower petioles sometimes 2-3 times as long. Pubescence rather scanty and closely appressed, of flat and broad hairs fixed near the middle. Stems slender, 1-5 ft. high, erect or nearly so, simple or slightly branched, few, perennial. Plants of the Middle Temperate life zone, rarely extending a little into the Lower Temperate, growing in moist meadows or along streams in poor soil in valleys, also on edges of copses, in open woods and on prairies.

KEY

A Pods not evidently inflated, narrowly oblong, triangular-beaked, a little arcuate, racemose, rather few, 1.2-2 cm. long, 4-5 mm. wide or high, with cross-section cordate to reniform. Flowers not in dense spikes. Plants with few internodes, the stems not over a foot long. Leaflets 5-8 pairs, about 1 cm. long.

Pods appressed-erect.

122 *terminalis*

Pods horizontally spreading.

123 *Oreganus*

2A Pods variously inflated, oval to oblong, conical-beaked, many, densely spicate, rarely loose below, closely appressed, with nearly round cross-section. Flowers greenish-white, nearly sessile in dense spikes. Tall plants, with many large and broad leaflets.

Pods with thick walls and little inflated.

124 *Canadensis*

Pods with thin walls and much inflated.

125 *neglectus*

122 *Astragalus terminalis* Watson Proc. Am. Acad. 17 370 (1882). Pods erect and appressed, about 4 mm. wide and 3 mm. high, somewhat arched, broadly sulcate and with septum partly intruded; tip declined a little but nearly in line with the ventral suture, about deltoid, flattened, ending abruptly in a subulate long mucro. Flowers purple and about 1.2 to 1.5 cm. long, nearly sessile but rather slender-pedicelled in fruit. Banner oblong, arched to erect beyond calyx tips, with sides reflexed 1 mm. wide in the middle, and about 7-8 mm. long. Wings oblong, 2-3 mm. longer than keel. Keel arched a little, short, purple, sharply rounded to a little more than erect, the erect part about as long as base and 3 mm. high. Calyx about 3 mm. long, the nigrescent teeth very short and wide. Fruiting pedicels 3-4 mm. long. The bracts ovate to subulate, hyaline, 1-2 mm. long. Peduncles subterminal and about as long as stems, strict, 1-2 dm. long, the floral rachis half as long. Leaves 5-15 cm. long, but root leaves shorter, with ovate folded leaflets, and petiole nearly half the whole. Upper leaves with shorter petiole, the leaflets linear-oblong to oblong-ovate and 7-12 mm. long. Leaflets 5-10 pairs, obtuse to retuse, distant, short-petiolulate, ashy below, rather thick. Stipules small, triangular and wide, about 4 mm. long. Stems tufted, spreading, rather zigzag, a foot long or less, slender, with the two upper internodes 2-5 cm. long, the rest short, from a woody root. Headwaters of the Snake river in the vicinity of St. Anthony and Spencer Idaho to Yellowstone Park and over on the headwaters of the Gallatin river on sagebrush plains. It has the general appearance of the broad-leaved form of *A. arrectus* but the pod is strictly sessile and thicker walled, while the peculiar pubescence puts it in this group. Middle Temperate life zone.

Astragalus terminalis* var. *reventoides (Jones Cont. 7 661 1895 as species). Flowers ochroleucous. Pods about 12 mm. long, almost truncate at both ends, about 6 mm. wide and 4 mm. high, with partition intruded one third the way across. Leaflets oval to elliptical and hoary, inclined to be notched, otherwise as in the type. On the headwaters of the Gallatin river Montana on sagebrush plains. Lima and Grasshopper Creek. A poor variety.

123 *Astragalus Oregonus* Nutt. in T. & G. Fl. 1 335 (1838) *A. ventorum* Gray. Pods horizontal, lanceolate-oblong, with triangular beak which is decidedly declined and flattish. Flowers ochroleucous. Banner ovate, a little longer than wings. Wings 2 mm. longer than keel, and 2 mm. wide. Keel straight and with tip rounded and erect. Calyx inserted on the lower corner, a little wider below; tube about 5 mm. long; teeth subulate and about 2 mm. long. Pedicels very short, bracts longer than pedicels. Peduncles shorter than the leaves, subterminal, about 7 cm. long. Leaves 7-12 cm. long, of 6-8 pairs of oval to obcordate leaflets which are thick, hoary on both sides and less than 2.5 cm. long. Stipules large. Stem hardly half a foot long, simple, erect, zigzag slender and from slender underground rootstocks, with few internodes which are rarely 2.5 cm. long. Pubescence ashy and rather long. In the upper Snake river valley Idaho and Wind river region Wyoming on sagebrush plains. These two species are but little known and may not be distinct.

***Astragalus Canadensis* Tourn** in L. 757. (I take up this name in preference to *Carolinianus* which has only priority by position, and should not displace Tournefort's name on a technicality, in addition the latter is only a local variation of the other widespread species). Pods oblong, about 1.5 cm. long, little inflated, about 5 mm. wide and high, a little obcompressed, rarely noticeably sulcate, densely appressed-spicate, smooth, with short mucro. Flowers yellowish- or greenish-white, very many, densely spicate, nearly sessile. Banner rather fleshy, arched far back, seemingly triangular because of the sides reflexed most at tip, nearly round, 5-8 mm. long. The groove V-shaped except at base. Wings linear, slightly wider at the blunt tip, ascending, about 2 mm. wide and 2 mm. longer than keel. Keel

Keel about as long as high, 3-4 mm. high, almost a half circle in outline, rounded at tip, often appearing to surpass the banner when it is much reflexed. Calyx hyaline, laterally flattened, somewhat gibbous, rather hairy, deeper cleft above, about 7 mm. long and 2-3 mm. high, inclined to be a little declined; teeth triangular to subulate, half to a third the tube. Pedicels almost none in the type. Bracts often as long as calyx tube, thin. Peduncles stout and strict, variable but about as long as the leaves, the spike 5-15 cm. long. Leaves often nearly a foot long, widely spreading, the middle ones the largest. The leaflets 10-14 pairs, smooth above, elliptical to lanceolate, not over 4 cm. long, very variable, obtuse, flat, thin, with cuneate base, the upper pairs smaller. Stipules papery, large, inclined to be connate. Stems stout, 2-5 feet high, strict, somewhat branched above, with internodes rarely over 7 cm. long. Pubescence ashy, on the upper side of leaves. Common throughout the region east of the Plains to the Atlantic and southward at least to Missouri and Texas, northward to Hudson's Bay and the Saskatchewan. Occasional forms nearly typical are found through Montana to the Pacific, but replaced westward mostly by the variety *Mortoni*.

Astragalus Canadensis* var. *Mortoni (Nutt.) Watson King's Rep. (8 (1871)). *A. Mortoni* Nutt. Jour. Phil. Acad. 7 19 (1834). *A. tristis* and *spicatus* Nutt. This is the western form of the species. Pods narrowly oblong, 7-12 mm. long, mostly densely spicate, not so closely appressed, rather deeply sulcate, mostly a little arched. Banner ovate. Keel purple-tipped. Calyx truncate at base and inserted at the corner. Bracts from ovate to subulate and 2-12 mm. long. Peduncles sometimes a foot long. Leaves rarely 1.5 dm. long. Leaflets inclined to be oblong, mostly 6-8 pairs, 1-3 cm. long. Stems rather decumbent below, frequently hardly a foot long. Some northern forms have the pods of *A. terminalis*. Common from New Mexico northward and northwestward to the Saskatchewan and California. Occasionally this has the pods of the next variety. It varies directly at all point into the type species.

Astragalus Canadensis* var. *Carolinianus (L.) Jones Cont. 7 647 (1895). *A. Carolinianus* L. 757. This has open spikes of white flowers which are not thick and fleshy. Pods oblong to oval, decidedly inflated, about 1 cm. long and apiculate. Leaflets large, elliptical-lanceolate and long-petiolulate. Stems slender, flexuous, erect, tall. Whole plant nearly smooth. This is the more common form of the southeastern states and northward to the Ohio river, though forms about the same rarely occur as far as Minnesota.

125 *Astragalus neglectus* (T. & G.) Sheldon Minn. Bot. Stud. 9 59 (1894). *Phaca neglecta* T. & G. Fl. 1 344 (1838). *A. Cooperi* Gray. Pods oval-ovate, truncate to cordate at both ends, about 2 cm. long, 7-12 mm. wide, quite oblique, variously sulcate at one or both sutures and both somewhat intruded, chartaceous to thin-coriaceous, much inflated, cross-nerved. Flowers about as in *A. Canadensis* except the calyx which is campanulate and nigrescent. Pedicels almost none. Bracts short. Peduncles slender, not longer than the leaves, rather spreading or sometimes erect, almost capitately 10-25 flowered. The leaves 7-12 cm. long, with upper petioles almost none. Leaflets 6-10 pairs, smooth above, ashy-woolly below, nearly contiguous, narrowly elliptical to linear-oblong, cuneate at base and long-petiolulate, rounded to retuse, about 2-3 cm. long, thin. Stipules triangular-ovate, 4-7 mm. long. Stems a foot or two high. Internodes 5-10 cm. long. On gravelly banks and in sandy open woods from Niagara Falls to Minnesota and Brookings S. Dak., along the Great Lakes, in the Middle Temperate life zone.

12 HYPOGLOTTIDES.

Pods 2-celled, broadly oblong to linear, nearly straight but oblique, not over 1 cm. long, inclined to be obcompressed with convex sides, not inflated, pubescent, not over 4 mm. wide, hardly twice the calyx, minutely stipitate, opening first at tip but only a little at any time, with cross-section triangular-cordate to reniform. Flowers densely spicate or in heads or subterminal on rather elongated peduncles, narrow, about 1.5-2 cm. long. Calyx tube short-cylindric to cylindric. Stipules conspicuously connate. Stems tufted or many, decumbent, rarely a foot long, from perennial roots. Plants of the Middle and Upper Temperate life zone.

KEY

Pubescence rather coarse, fixed near the middle	126	<i>nitidus</i>
Pubescence very fine, fixed at the base.	127	<i>agrestis</i>

Astragalus nitidus Douglas in Hook. Fl. Bor. Am. 1: 149 (1834).
 pods sulcate, oblong to narrowly so, 7-10 mm. long, 3-4 mm. high, chartaceous, hoary with minute and appressed pubescence, never more than twice as long as calyx, rather laterally flattened toward tip, spicate or rarely racemose, shortly stipitate, little arcuate when longer: with ventral suture convex at tip and with declined point; cross-section reniform to triangular; septum produced nearly to the ventral suture. Flowers quite variable but normally white, sometimes purple, densely set in oblong heads, appressed in flower and fruit, about 1.5 cm. long. Banner oblong and often much elongated, 7-12 mm. long, variously arched below calyx tip to 20-45 degrees. Wings linear to oblanceolate, from a trifle longer to 4 mm. longer than keel and 2-4 mm. shorter than banner, narrower than keel, but little arched, obtuse. Keel nearly the same width throughout, half-oval-obovate, from nearly straight along the upper side to square at the erect or slightly out-turned tip, colored, 3-7 mm. long, about 2-3 mm. high. Calyx tube short-cylindric, 3-6 mm. long and about 2 mm. high, rather acutish at base and equally inserted, scarcely to somewhat oblique at tip, hyaline and inclined to be nigrescent with closely appressed hairs, sessile, the subulate teeth fully half as long as tube and often with threadlike tips. Bracts nearly as long as calyx tube, triangular and hyaline. Peduncles about 1 dm. long, generally twice as long as spikes, sometimes a foot long, stout and sulcate. Leaves 7-12 cm. long, little tapering, all somewhat petioled but the upper petioles short. Leaflets 6-12 pairs, 1-4 cm. long, narrowly elliptical to linear-oblong or lanceolate, 4-7 mm. wide, flat, rather rigid, acutish to acute, closely silvery with very delicate hairs fixed near the middle and closely appressed, the pubescence varying from white to sparse, and plants then green. Stipules large, scarious. Stems decumbent, about a foot long, with few and rather long internodes and many root leaves, from a thick and woody crown. From the Plains at Santa Fee New Mexico northward through Colorado and western Nebraska to Assiniboia, westward to

Lima and Deer Lodge valley Montana, and Silver and Medical lakes Washington, and to the main range in Colorado, but not in the Great Basin. Open prairies and meadows, in gravelly and well drained soil. Middle Temperate life zone.

This belongs to the same class as *A. Onobrychis*, *leontinus*, and *microphyllus* of Europe, as well as *adsurgens* (to which this species is generally referred).

Astragalus nitidus* var. *robustior (Hook. Fl. Bor. Am. 1 149 1834 as *adsurgens* var.) This is *A. striatus* Nutt., *sulphurescens* Rydberg, *Chandonetii* Lunel. Flowers white, in short heads, on elongated peduncles. Calyx teeth long. Hardly a good variety. Same range.

Astragalus adsurgens Pallas, to which this species is referred, and which botanists assume is *A. Laxmanni* DC. does not have the conspicuously connate stipules, while Japanese plants (so named but evidently a distinct species) have the connate stipules, but oval leaflets, divaricate leaves and peduncles which latter are shorter than the leaves.

This species has many of the characteristics of several groups. It at once suggests relationship to the *Uliginosi* by the pubescence and general habit. It appears related to the *calycosus* and the *Spaldingii* groups but it is manifestly closest to *A. agrestis*, and this is nearest to the *Chaetodontes* which, in turn, are related to the *Didymocarpi*, and more remotely to the *Micranthi*.

127 ***Astragalus agrestis*** Douglas in Hook. Fl. Bor. Am. 1 148 (1834), *A. goniatus* Nutt., *A. Carletonis* Rydberg. Pods chartaceous, with ventral suture raised and thick and sharp-edged and usually triangularly and laterally flattened, but in old pods the cross-section is often reniform, pods ovate to oblong-oval, broad, very blunt at both ends, obcompressed, scarcely longer than calyx, usually white-shaggy, and always white-villous at tip, oblong, 7-10 mm. long, splitting like calyx, in dense heads, with wide dorsal groove and deeply sulcate dorsally, often almost to the ventral suture and with narrow septum. Flowers few to many, purple, with white wings or rarely all white, erect, 12-20 mm. long, in dense heads which are oblong to short-cylindric and about 2.5 cm. long. Banner elongated, with obovate blade, about 12 mm. long, slightly ascending, a little hooded at tip, abruptly arched at calyx tips to 15-45 degrees, about 4 mm. longer than wings, with sides reflexed a very little; white spot obovate-cuneate, often subulate-tipped, purple-striate and comes within 4 mm. of tip; groove V-shaped and vanishing above. Wings linear-oblong, oblique, rounded, about 4 mm. longer than keel, straight or ascending parallel with the banner, about 1 mm. wide, veined (as are all the petals), with light-purple base and white above. Keel about three times as long as wide, with the triangular tip barely acute and mostly erect, being rounded in a gentle curve to the tip, purple, 4-5 mm. longer than calyx, straight. Calyx cylindric to campanulate-cylindric, 4-7 mm. long, straight, not oblique, narrowed below, with straight and linear-subulate teeth which are green and shaggy with variously mixed black and white hairs, and teeth a half to two thirds as long as tube. Pedicels stout and very short. Bracts oblong to ovate or linear, green, very conspicuous, the lower ones obtuse, the rest acute, often with hyaline margins, about equaling the calyx tube, the lower ones often as large as the leaflets. Peduncles 5-12 cm. long, deeply sulcate, longer than the leaves, erect. Leaves narrow, delicate, 4-10 cm. long, all petioled. Leaflets narrowly elliptical to oblong or rarely linear, sometimes a trifle narrowed above, truncate to notched, 6-10 pairs, 1-2 cm. long, mostly smooth, often puberulent, flat and thin. Upper stipules the largest, conspicuously sheathing, blunt (rarely acute), often 1.5 cm. long, leaflike. The stems weak and almost filiform, rarely a foot long, leafy but with slender internodes, with bases interlaced and with filiform underground stems and running rootstocks, erect only in dense meadows where supported by grass. Pubescence rather loose, appressed, short, never dense except on the calyx, with hairs fixed by the base. Com-

mon in subalpine and rather moist meadows even to the Middle Temperate life zone in open and sunny but moist places, and even in open woods from Dakotah and Nebraska to New Mexico, and westward to the Sierras, and northward to the Arctic. *A. Hypoglottis* var. *bracteatus* Osterhout is only a form with larger bracts than normal. *A. Hypoglottis* var. *polyspermus* T. & G., *A. virgultulus* Sheldon is the form growing unsupported by other plants in more exposed places, and is ashy-puberulent, with pods about 7 mm. long, and short internodes. All forms bloom in late summer.

The European *A. Hypoglottis* L. (its closest ally), with which this has been confused, has longer stipe; pods broader, mostly oval, very blunt at both ends, simply hairy, about 5 mm. long, triquetrous to much obcompressed; banner short, oval, 3-4 mm. longer than keel; wings oblong, barely 1-2 mm. longer than keel; calyx short-campanulate, 4 mm. long, over 2 mm. wide, with the subulate teeth half to a third as long as the tube; bracts about 2 mm. long, not enlarged and leaflike, subulate-pointed, ovate to linear-lanceolate; peduncles longer than the leaves; leaflets lanceolate, acute or obtuse, not notched, about 8 pairs; stipules much smaller, rarely 1 mm. long; pubescence spreading, sparse, of long and slender hairs.

13 CHÆTODONTES.

Pods not over 1 cm. long, 2-celled, sessile or nearly so, rarely a little arcuate, oblique, opening first at tip along both sutures, in heads or spikes, small, not inflated, chartaceous, mostly sulcate dorsally, opening but little at maturity, with triquetrous to reniform cross-section. Flowers not over 1 cm. long, broad. Calyx tube campanulate, rarely 4 mm. long, with subulate or filiform teeth about as long as tube, closely sessile. Bracts elongated. Very pubescent, tufted plants from woody perennial roots.

KEY

A. Caespitose plants with very short internodes, conspicuous and hyaline and connate stipules, and leaves 2-3 cm. long. Flowers purple, in heads on short peduncles. Pods not longer than calyx, very hairy.

128 *Austinae*

2A. Plants erect or only decumbent, tufted, with slender stems at least a foot high, with slender internodes, open habit and narrow leaves. Stipules connate only at very base. Leaves 5-10 cm. long, the upper ones sessile or short-petioled. Flowers in spikes, rarely in heads, and pods in spikes.

2AB. Pods not laterally flattened nor longer than calyx.

Pods not reflexed.

129 *Spaldingii*

Pods reflexed.

130 *Brauntoni*

2A2B. Pods conspicuously laterally flattened, oblong lanceolate and very sharp, much longer than calyx, 6-10 mm. long. Flowers and pods reflexed and in narrow, long, loose spikes.

131 *Lyallii*

128 *Astragalus Austinae* Gray Bot. Cal. 1: 156 (1876). Pods about 7 mm. long and 3 mm. wide, oblong to elliptical, not exerted, shallow sulcate, barely splitting the calyx, barely acute, with rounded tip, at base notched and short-stipitate, conspicuously 1-celled at tip, with ventral suture raised and thickened but not acute, with dorsal suture produced toward but not to the ventral, a little flattened laterally, inclined to be reflexed, with cross-section nearly circular, the groove not running to the tip. Flowers inclined to be reflexed, 7-10 mm. long, sessile, 10-12, purple-veined and with light-colored blades, barely 2 mm. longer than calyx. Banner oval-ovate, about 4 mm. long, abruptly arched at end of calyx to 30-60 degrees, about 3 mm. longer than wings, with sides reflexed about 1 mm. wide and most in the middle but not at all at tip; groove U-shaped, broad, filling the whole banner above. Wings linear to oblong, about 1 mm. longer than keel, a little arched, obtuse, the right hand one folded over the keel, the other flaring, both wings and banner hairy on the outside. Keel short, straight, 2 mm. high, incurved at tip to 110 degrees, purple, barely as long as calyx, the tip a knob and very blunt. Calyx narrowly campanulate, the tube about 3 mm. long, inserted on the lower corner, cleft deeper above, not narrowed below; teeth green, unequal, arched and lax, filiform, not shorter than the tube. Bracts subulate, 4-7 mm. long, thin. Peduncles 2-7 cm. long, erect, rather stout, mostly longer than the leaves, subscapose though actually in the upper axils. Leaves clustered, spreading, the lower long-petioled. Petioles stout, not sulcate,

never less than half the whole. Leaflets acute at both ends, often folded, stiff, not petiolulate nor contiguous, 10-13 mm. long. Stipules hyaline, very hairy, about 1 cm. long. Stems hardly 1 dm. long, much branched, densely leafy, rather stout, woody, prostrate, with short internodes. Pubescence of the whole plant even to the pods, bracts and outsides of petals shaggy with long white hairs which are more appressed on the leaflets and less dense on the pods. This grows on dry and rocky ridges in the sagebrush in the Sierras from Summit Nevada Co. California and northward to Oregon, along with *A. Hookerianus*, *Eriogonum umbellatum*, and *Symphoricarpos*. Middle Temperate life zone.

129 *Astragalus Spaldingii* Gray Proc. Am. Acad. 6 524 (1865). *A. Chaetolon* Torr., not Bunge. Pods erect or ascending, 5-7 mm. long, oblong oval, straight or rarely concave (very seldom a little arched and sharp pointed and laterally flattened), obliquely apiculate or rarely triangular beaked, with ventral suture a little convex (but not as much as the dorsal), rarely at all sulcate dorsally, usually shaggy-pubescent, rarely less so, rounded at base and filling the slightly inflated calyx, with cross-section nearly round but a little flattened laterally. Flowers 7-10 mm. long, white, erect, in dense heads which are about 2-3 cm. long and which mostly elongate to spikes in fruit. Banner oval, veined with purple, about 4 mm. long, arched abruptly to erect at tip of calyx, with sides reflexed about 1 mm. wide. Wings 4 mm. long, narrowly and obliquely elliptical, a little arched, fully 2 mm. longer than keel and 2 mm. shorter than banner, about 3 mm. wide. Keel very short, about 1 mm. longer than calyx, about 2 mm. high and 2 mm. long, deltoid, purple. Calyx very villous, about 3 mm. long, campanulate to nearly hemispherical in fruit, rounded at base, with the teeth toothlike and about 4 mm. long. Pedicels none. Bracts setaceous, about 4 mm. long, with threadlike tips. Peduncles about twice as long as the leaves. Fruiting spikes 2-7 cm. long, often loose at base. Central leaves about 1 dm. long, the upper ones sessile. Leaflets 7-12 mm. long, 8-10 pairs, lanceolate, to linear-oblong, cuspidate. Stipules subulate, green, produced into long and threadlike tips about 1-1.5 cm. long. Stems slender, many, decumbent, 1-2 feet long, nearly simple, with slender internodes. Pubescence long-villous over the whole plant, especially on the calyx, less dense on the leaves, with hairs sinuous, very slender and attached by a pustulate base. This species is rather common on hills and plains of the Columbia Basin to Baker City on the east and Honey Lake on the south, not in the Flathead region. Middle Temperate life zone, in gravelly and clay soil.

130 *Astragalus Brauntoni* Parish Bull. S. Cal. Acad. Sci. 2 26 (1902). Pods oval-ovate, about 5 mm. long, 2 mm. wide and 1 mm. high, notched at base, abruptly rounded at both ends, chartaceous, softly short-villous, spicate, reflexed on a stout pedicel 1 mm. long, with straight dorsal suture and upturned acuminate flat beak about 1 mm. long, with longitudinal section half-oblong-oval, with cross-section oblately deltoid-cordate and pod broadly sulcate to the middle and septum produced nearly to the ventral except at tip. Flowers in a spike 5-7 cm. long, reflexed, about 1 cm. long, pinkish, with petals about as long as calyx and teeth. Banner nearly round, 3-4 mm. long, but little arched, about 2 mm. longer than wings, with margins a little reflexed all around. Wings broadly oblong, rounded, 2 mm. wide, about 1 mm. longer than keel. Keel about 3 mm. long and high, the tip rounded to a little more than a half circle, the upper side about straight, the longitudinal section half-cuneate-obovate. Calyx campanulate, 3-4 mm. long and nearly as high, rather truncate below and inserted on the lower corner and sessile in flower, hardly oblique above, with filiform, green, lax lobes nearly twice as long as tube. Bracts filiform-subulate, thin, lax, about 1 cm. long. Peduncles rarely 5 cm. long, much shorter than the leaves, and rather shorter than the fruiting rachis. Leaves 1-2 dm. long, recurved, narrow and tapering, short-petioled, with short tapering leaf-rachis. Leaflets nearly 15 pairs, ob-

long-lanceolate to elliptical, apiculate, flat, long-petiolate, nearly contiguous, the largest about 2 cm. long. Stems stout, decumbent, 2-3 feet long, often 5 mm. thick, flexuous, with internodes rarely 5 cm. long. Stipules subulate, lax, thin, hardly 1 cm. long, with threadlike tips. Pubescence softly white-villous all over, the stems white, the leaves greener. A very robust plant of the foothills near Santa Monica California, Braunton. Tropical life zone. This is a most unexpected addition to the group.

131 *Astragalus Lyallii* Gray Proc. Am. Acad. 6 195 (1864). Phaca Piper. Pods very variable, straight, pungently acute, flat at tip, narrowly sulcate dorsally, about 3 mm. high and 1-2 mm. wide, closely reflexed, splitting the calyx, hoary or smooth, finely cross-nerved, about 5 mm. long, 2-celled to tip, triangular-ovate to oblong-lanceolate (rarely oval), with cross-section narrowly triangular-cordate to broadly cordate-ovate, with ventral suture raised and thick, pod but little convex on the dorsal side. Flowers white or tinged with purple, about 6-7 mm. long, nearly sessile. Banner ovate, often purple-striate 4-5 mm. long, abruptly arched at end of tube to nearly erect, with sides much reflexed so that outline is nearly linear. Wings oblong-lanceolate, but little arched, narrower than keel and from 2 mm. longer to only a little longer than keel, 3 mm. shorter than banner. Keel with nearly straight base, about 3 mm. long and high, very abruptly rounded at the end to more than erect, the tip being deltoid, obliquely truncate, colored, not surpassing calyx teeth. Calyx tube turbinate to campanulate, about 2 mm. long, narrowed below, blackish with shaggy hairs about as long as tube, the filiform teeth very lax and often twice the tube. Pedicels slender, about 1 mm. long in fruit. Bracts subulate, lax, about 2-4 mm. long. Peduncles slender, rarely 3 cm. long. Floral rachis erect, tapering, often 1 dm. long. Central leaves about 6 cm. long, mostly sessile, spreading, rather broad. Leaflets 6-8 pairs, not contiguous, 1-1.5 cm. long, narrowly elliptical to almost linear, acute, softly appressed-hoary-silky with very fine and long hairs. Stems nearly erect, a foot or two high, flexuous, with peduncles in most of the axils, more hairy than the leaves, with internodes 3-5 cm. long, nearly simple. Stipules inconspicuous, small with threadlike tip. Whole plant silvery-silky. Some forms shade toward *A. Spaldingii* in shape of pods and pubescence but the pods are conspicuously exserted from the calyx, always reflexed. Calyx much smaller and lobes lax and relatively longer than in the other species. Stems from woody roots. From Glenn's Ferry Idaho to the lower Columbia Basin, growing on prairies and in sandy places. Lower part of the Middle and upper part of the Lower Temperate life zones.

***Astragalus Lyallii* var. *caricinus* N. Var.** Leaflets linear lanceolate and acuminate, very sharp-pointed, 1-2 cm. long. Calyx lobes almost capillary and much longer than the tube, lax and long-villous. Pods mostly reflexed, nearly 1 cm. long, half oval-ovate to oblong-lanceolate, acuminate, thin, often nearly smooth and cross-veined, sulcate to the middle (less so below) and with septum intruded to the ventral suture or more, very much laterally flattened, and with cross-section cuneate with a cordate base, with both sutures arched but the dorsal the more. Plants about a foot and a half high and densely tufted from a woody root. This grows on sand dunes at Glenn's Ferry Idaho on hillsides. There are all sorts of integrations. Lower Temperate life zone. The pods are shaped like a buckwheat or *Carex* grain (but not as wide as the former) and hence the name.

14 LOTIFLORI.

Pods either sulcate dorsally or partly 2-celled by the intrusion of the dorsal suture, splitting through the ventral suture as in the Alpini but not wholly through the dorsal, coriaceous to cartilaginous when dry, 5-30 mm. long, mostly ascending, somewhat oblique or a little arcuate, with reniform, triquetrous, or quadrangular cross-section, inflated only in lotiflorus, sessile and rounded at base, tip triangular and acute (apiculate in *A. circumdatus*). Flowers 5-8 mm. long, mostly white or light-colored, rather few, in heads or very short-spicate, short-clawed, with short petals. Calyx campanulate, with tube 2-4 mm long. Bracts mostly short. Stipules not connate, subulate or triangular or deltoid. Slender caulescent perennials from rather woody roots, mostly low plants.

KEY

A. Pods oval to oblong, little oblique, not inflated, about 1.5 cm. long, straight, very fleshy (the pulp 2-3 mm. thick when fresh and the cross-section then about round, but inclined to quadrangular when dry), apiculate or very short-pointed, splitting the calyx, sessile when fresh, about straight, with the ventral suture raised and thick. Calyx teeth triangular, tube 2-3 mm. long. Pubescence very short and closely appressed, white, composed of fine hairs. Bracts very small, deltoid to triangular, rather thick and hairy. The stems are somewhat intricately branched and depressed.

AB. Pubescence attached by the base. Fruit on rather slender pedicels which are at least as long as the deltoid bracts. Calyx teeth triangular and about as long as tube. Tropical. *Circumdati*.

Pods nearly smooth. Flowers nearly white.

Whole plant almost smooth. 132 *circumdatus*.

Pods ashy. Flowers deep-purple-tipped.

Whole plant silvery-pubescent. 133 *Mohavensis*.

A2B. Hairs attached near the middle. Pods nearly sessile. Calyx teeth much shorter than the tube. Ventral suture of pods the more convex. Not Tropical. *Accumbentes* 134 *accumbens*.

2A. Pods oblong-lanceolate, acuminate, inflated, 1-celled, but dorsal suture sometimes a little thickened within, 2-3 cm. long, nearly 1 cm. high and wide, coriaceous, only a little fleshy when green. Leaflets narrow. Flowers capitate, white or nearly so. Calyx lobes arcuated and as long as the tube. Pubescence of hairs attached near the middle. Not Tropical. *Lotiflori*. 135 *lotiflorus*

132. *Astragalus circumdatus* Greene Pitt. 1, 173 (1888). Pods oval-oblong, few, about round in cross section when fresh, decidedly fleshy and pulpy faintly corrugated when dry, nearly acute at base, 1.2-1.8 cm. long, about 7 mm. high, 5 mm wide, straight, a little narrowed below, erect or spreading, green and barely pubescent when ripe, hoary when young with very short and appressed hairs, dorsal suture neither raised nor thick but a little convex; tip triangular and placed in the middle of the end. Flowers 5-12 indifferently spreading, white, 7 mm. long, short and stubby. Banner oval, white, very wide below, abruptly

arched at calyx tips to nearly 90 degrees; sides reflexed fully 2 mm. wide, blade 3 mm. long. Wings oblong, with narrow base, ascending, rather acute, barely as long as keel. Keel 1 mm. shorter than the banner, dark-tipped, produced into an acuminate erect tip 2 mm. high which is abruptly incurved to 90 degrees, straight and like that of *A. campestris*. Calyx a little over 2 mm. long, not arched, nor cleft deeper above, short-campanulate, green, narrowed below, densely white-hairy, teeth subulate, as long as tube, not unequal. Pedicels slender, 2-5 mm. long, much longer than the bracts. Bracts minute but conspicuous, hyaline. Peduncles about 4 cm. long, slender, about 10-flowered, shorter than the petioles. Leaves all petioled, 2.5-7 cm. long, the lower the smallest, the uppermost the largest; petiole shorter than the leaf-rachis. Leaflets oblanceolate to oval 2-10 mm. long, folded, petiolulate, 8-14 pairs, very obtuse, nearly contiguous. Stipules hyaline, conspicuous, almost connate below, not adnate, reniform to deltoid, seldom over 2 mm. long, often twice as wide as long, very much like those of *A. juaceus*. Stems prostrate, many, slender, weak, woody at base, not over 1.5 dm. long, internodes seldom over 1.2 cm. long, often very short, knotty. Rather woody rooted, green perennial. Pubescence ashy to nearly glabrous, very sparse except on young parts. Peninsula of Lower California. Tropical. The plants form close mats on the ground.

133. *Astragalus Mchavensis*, Watson Proc. Am. Acad. 20 361 (1885). Pods narrowly oblong, plum-shaped, about 1.8 cm. long, 5-7 mm. wide, and 3-5 mm. high, with pulpy wall 2 mm. thick when fresh and not thick inner walls, which separate from the outer much as in *A. cymboides*, nearly straight, jointed to a minute stipe when dry or weakly attached, sessile when green, a little narrowed below, reflexed, coriaceous, ashy, rigid or faintly corrugated, opening all along the ventral suture, imperfectly 2-celled by the partial intrusion of the dorsal suture, cross section elliptical-ovate when dry and almost round when fresh but sometimes cordate, both sutures prominent, raised and thin when dry only, tip 1-celled and flat and very shortly triangular acute with a rather long mucro which is about in line with the middle of the end, cavity triquetrous, hairy and pulpy. Flowers 5-15, about 7-8 mm. long, not stubby, purple tipped, shortly-racemose, ascending. Banner about 5 mm. long, arched to 45-90° at the end of calyx tube, 3 mm. longer than the keel, sides reflexed 1-2 mm. wide and most in the middle, white spot ovate to oblong or obovate-oblong and purple veined and stopping 1 mm. short of the tip. Wings 1 mm. wide, as long as keel, ascending, oblanceolate to oblong, rounded, nearly straight, oblique, darker above, 4 mm. shorter than banner. Keel 3 mm. wide, purple, 2 mm. shorter than banner, tip larger, rounded, blunt, erect, arched to $\frac{3}{4}$ circle in a short arc, base about straight to a little arched, blade 4 mm. long. Calyx turbinate to campanulate cylindrical, not arched nor evidently cleft deeper above, about 3 mm. long, not flattened, fleshy at base, nearly equally inserted; sinuses broad; teeth as long as tube, equal and subulate. Pedicels not over 2-3 mm. long about as long as the bracts in fruit only and stout. Bracts ovate to subulate. Pedicels in flower about 1 mm. long. Early peduncles sessile, the later ones axillary throughout, racemosely fruited above, 7-15 cm. long, slender, a trifle longer than leaves when mature including the rachis. Leaves 5-10 cm. long with the petioles as long as the rachis, or on the lower leaves much longer. Leaflets broadly elliptical to obovate, cuneate at base, rarely 1.5 cm. long, 2-5 pairs, rather distant, apiculate to truncate, the central ones the largest. Stipules deltoid, adnate, hairy, rather stiff, small. Stems flexuous, not over a foot high, much branched, widely spreading, often forming masses a yard in diameter. Internodes rarely over 5 cm. long. Pubescence silvery even to the stipules, with slender, and dense very echinate hairs, the stems more pubescent than the leaves. The plants bloom as winter annuals and continue for a few years. Rather common in rocky canons and on

cliffs from Charleston Mts. to Keeler. Tropical.

134. *Astragalus accumbens* Sheldon Minn. Bot. Stud. 9 20 (1894).
A. procumbens Watson. Pods 1.2-2 cm. long, oblong-oval, about 7 mm. high, wrinkled, puberulent, dorsal suture a little intruded, cross section nearly round even when dry, rounded at both ends. Flowers nearly sessile even in fruit, stubby, white or purplish, spreading, few, rarely more than 3 pods mature, capitate, 6-10, 6-8 mm. long, the blades about as long as calyx. Banner almost round, arched to erect, in broad curve beyond calyx tips, barely longer than keel, with sides reflexed about 1.5 mm. wide in middle. Wings arched almost to a half circle, very obliquely oblanceolate, a little longer than keel. Keel with base arched and tip incurved to more than erect and abruptly, barely acute. Calyx rather long-campanulate, about 3 mm. long and 2 mm. high, dark-hairy with appressed pubescence, scarcely at all flattened laterally, teeth arched and triangular, about $\frac{1}{4}$ - $\frac{1}{2}$ as long as tube. Bracts triangular, 2-3 mm. long, much longer than the very short pedicels. Peduncles subscapiform, 8-10 cm. long, ascending, much longer than leaves. Leaves 5-7 cm. long, with petioles over half the whole, slender. Leaflets 5-7 pairs, about 7 mm. long and 3 mm. wide, sessile, thick, oblong obovate, rounded, somewhat silvery with appressed hairs. Stipules broadly ovate to deltoid, acute, about 5 mm. long, hyaline, adnate, large for the plant, either imbricated or the internodes very short. Root erect and much branched at tip with short and woody stems, 2-15 cm. long, then again branched as much and as long and stems rather ascending, forming a rather open mat, the habit being much that of *A. calycosus*. This looks like a diminutive *A. Missouriensis* but is of another group. First collected by Dr. Palmer in 1869 and referred to *A. tephrodes*, then by Dr. Havard at Fort Wingate, Marsh, and later by Lemmon at Laguna, New Mexico. Lower Temperate life zone, on dry benches.

135. *Astragalus lotiflorus* Hook. Fl. Bor. Am. 1 152 (1834). Phaca T. & G.. Pods mostly straight, both sutures convex but the dorsal more so, rarely when pod is arcuate the ventral suture is concave, laterally compressed and cross section triquetrous or deltoid-cordate when it is shallow-sulcate dorsally, flat and triangular-acute at tip, closely appressed and rather long-hairy, ascending to reflexed. Flowers mostly reflexed, about 5-7 mm. long, almost sessile, sometimes cleistogamous, about 10. Banner oval to round, abruptly erect at end of calyx teeth or nearly so, notched, about 5 mm. long, nearly a half longer than keel, often purple-veined above, sides reflexed. Wings narrowly-oblong, obtuse, nearly 2 mm. wide, somewhat longer than keel. Keel straight hardly surpassing the calyx tips, arched to erect at the truncate end, 2 mm. high, dull-purple. Bracts subulate to triangular, hairy, about equaling the calyx tube. Calyx tube 2-3 mm. long, appressed-long-hairy. Peduncles slender, often very short, subscapiform. Leaves 5-15 cm. long, the petiole about half the whole. Leaflets about 5 pairs, elliptical to oblong and acutish at both ends, 5-15 mm. long, rather distant, nearly smooth above. Stipules ovate, acuminate rarely overlapping. Stems very short but slender and branched, diffuse, rarely more than 2-5 cm. long, forming small mats on the ground and very leafy. Whole plants variably silky-pubescent with hairs mostly appressed, sometimes spreading on the pods. Common on the Plains from the Saskatchewan to Texas but only on the Atlantic slope, blooming in spring. The var. *brachypus* Gray. (*A. elatiocarpus* Sheldon and *A. ammolutus* Greene) has flowers sessile spreading pubescence. This is rather common at the north but hardly among the leaves and mostly cleistogamous, and arcuate pods with deserves varietal rank as it grows with the other forms and often has sessile and long-peduncled flowers on the same plant. The var. *Reverchoni* (Gray) Jones which is *A. cretaceus* Buckley, *A. lotiflorus* var. *Nebraskensis* Bates, and *A. Batesii* Nelson has long peduncles and nar-

row pods and is more common at the south. This form has short bracts and calyx lobes and less inflated pods. The species extends eastward to western Iowa and Dakota and Missouri. Middle and Lower Temperate life zones on plains and open prairies in gravelly soil.

15 ATRATI.

Pods oblong to nearly linear, cartilaginous to coriaceous, rarely chartaceous, not inflated (a little so in *A. atratus*), variously 2-celled by the intrusion of the dorsal suture, sulcate dorsally (except in the variety *mensanus*, rarely at all ventrally, with the cross-section round or nearly so), pod sessile or only minutely stipitate, inclined to be wider above the middle, about 1.2-2.5 cm. long, rarely 5 mm. wide or high, opening first at tip, racemose, ventral suture the more arched and pod arcuate downward and seemingly upside down. Flowers short, rarely 1 cm. long, wide and stubby (not stubby in *Panamintensis*), white or greenish, seldom purplish, with campanulate calyx and narrow teeth, on slender pedicels much longer than the bracts (flowers nearly sessile and bracts longer than the pedicels in *A. obscurus*). Bracts and stipules small, the latter not connate. Leaves narrow and with relatively elongated rachis tapering and rather rigid. Leaflets few (rarely 3 pairs), narrow, mostly short, sub-alternate, distant, mostly much reduced above and inclined to abort. Stems, leaf-rachis and peduncles all green. Stems short and slender, with rather many very short internodes below and inclined to be caespitose (rarely somewhat elongated and with a few long internodes above), prostrate to decumbent, perennial. This group grows only in the Great Basin, Death Valley and southern edge of the Columbia Basin in arid places, rarely among grasses.

KEY

A. Pods cartilaginous when dry, fleshy when fresh, very oblique, mottled, widely spreading or a little reflexed. Proper stems almost none, caespitose, with stipules mostly overlapping. Flowers few.

136 *Salmonis*.

2A. Pods not cartilaginous, mostly slightly fleshy when fresh, nearly straight, almost linear, rarely at all mottled. Some of the stems with long internodes. Leaflets mostly sharp.

2AB. Stems slightly if at all branched and not densely tangled. Peduncles conspicuous and elongated (except in *A. Ibapensis*). Flowers greenish-white, with mostly sharp keel.

2ABC. Flowers and pods erect or ascending. Pedicels very short. Flowers in heads, or rarely spicate. 137 *obscurus*.

2AB2C. Pods reflexed or pendent, opening along both sutures. Flowers mostly reflexed. Pedicels elongated and slender and much longer than the short bracts.

Flowers several, in long racemes. 138 *atratus*.

Flowers 1-2 at the ends of filiform peduncles shorter than the leaves. 139 *Ibapensis*.

2A2B. Stems densely and intricately branched forming broad mats a few inches high. Peduncles hidden among the leaves. Flowers few, purple, not stubby. Pods oblong, triquetrous in cross-section, flat-apiculate, straight.

140 *Panamintensis*.

136. *Astragalus Salmonis* Jones Cont. 8 9 (1898). Referred to *A. Bourgovii* by Watson and Gray. Young pods rather triquetrous in cross section, in age reniform, weakly attached to calyx and sessile or silipe half the calyx, abruptly contracted below, very obliquely oblong, about 2 cm. long, 5-7 mm. wide and high, strongly and closely cross-ribbed when fresh with the outer wall fleshy and pulpy and the inner woody and the cavity filled with pulp, the septum intruded half way, shallow and broadly sulcate nearly to tip and base, and canoe-shaped dorsally, rounded ventrally and the thick suture raised when dry but not when fresh, the deltoid and very short tip about at right angles to dorsal suture and declined, seemingly glabrous but minutely pubescent, rarely pendent, 1-3. Flowers about 3 and loosely racemose, purple tinged, about 1 cm. long, broad. Banner nearly 1 cm. long, oblong-oval, deeply notched, veined from the back, the midrib purple and with a thickened groove on each side running two-thirds the way to tip, resembling *Fraseria* glands, then the thin sides are reflexed 45° from the edge of the groove below but not at tip, arched gently at end of calyx to 45° , dirty-greenish-white with a purple tinge. Wings broadly linear, 2 mm. wide, rounded, 8 mm. long and equaling the banner, erose, not narrowed above, arched at end of keel to 45° , concealing it, about flat and close-pressed to it. Keel purple-tipped, sharply rounded to about 135° , obtuse, short, straight, 4 mm. shorter than wings, about 3 mm. high. Calyx 4-angled, the tube about 4 mm. long, barely wider above, oblique at base by the lower corner being cut off and so seeming saccate above, equally inserted, appressed-short-hairy and nigrescent; teeth subulate and about half as long, a little oblique at tip. Pedicels 2-4 mm. long, at least twice as long as the hyaline ovate bracts. Peduncles subscapose, 1-2 dm. long, rather stout, ascending to erect in flower and prostrate in fruit. Leaves 5-10 cm. long, very many and very narrow, with the stout petiole about one-third the whole. Leaflets about 6 pairs, rather thick 3-5 mm. long, elliptical and obtuse, mostly folded and appearing linear, seemingly sharp but mostly obtuse. Stems rarely 2-5 cm. long, many from a much branched and woody crown from a thick and erect root. Whole plant puberulent. Growing on dry rocky ridges, Blue Mts. Oregon and vicinity. Middle Temperate life zone and in flower in early spring.

137. *Astragalus obscurus* Watson Bot. King 69 (1871). Pods short-racemose, shortly-acuminate at both ends, broadly linear, about 2.5 cm. long and 3 mm. wide and high, rather triquetrous-reniform in cross section, inclined to be a trifle laterally flattened, coriaceous and a little fleshy when fresh, not reticulated nor ribbed, both sutures raised externally and the ventral thickened when dry, often reddish but not mottled, narrowly and shallow sulcate dorsally, the dorsal suture variably intruded from a mere trace to nearly the width of the cavity, ashy with close pressed hairs as is the whole plant, sessile on a very stout pedicel about 2 mm. long which is about as long as bract, the straight tip in line with the dorsal suture not declined. Flowers at first in heads then elongating a little, less than ten, about 8 mm. long. Banner oval, about 7 mm. long, abruptly and nearly erect from calyx tips, with sides reflexed about 1 mm. wide below only, filled by the very broad and large sulcus which is triangular and sharp and 2 mm. deep, broader at tip, with conspicuous purple stripes radiating palmately from the end of the thick claw. Wings very obliquely obovate, ascending 45° , close pressed to keel below with the upper side concave to it and flaring and so the blade seems grooved along the middle, very obtuse, rounded, shorter than the keel and narrower, about 1.5 mm. wide. Keel straight, with tip very sharply rounded to erect and then produced into a straight and sharp or rounded tip, 3 mm. high, dark-yellow. Calyx a little obcompressed at tip with broad sinuses whitish tube about 2 mm. long, with the triangular teeth about half as long,

oblique at base and fleshy, rather unequally inserted, nigrescent. Peduncles 1-2 dm. long, longer than the leaves, erect in fruit, often decumbent in flower. Leaves 5-8 cm. long, numerous at the crown, narrow, with petiole half to a third the whole. Leaflets 3-6 pairs, broadly linear to elliptical, or even some oval-obtuse, thick, most of them narrow, 3-10 mm. long. Stems with 2-3 slender internodes 2-5 cm. long, flexuous, prostrate, at length nearly erect, rather caespitose and tufted from a woody root. Often 2-3 dm. long. From Reno to Palisade and possibly Hawthorne, Nevada and vicinity to the Blue Mts. Oregon, growing in sagebrush and among *Atriplex confertifolia* on plains and slopes. Middle and upper part of the Lower Temperate life zone, blooming in late spring. Reported probably erroneously from Panaca, Nevada. The relationship of this species to *A. atratus* is very close in some forms and they nearly always grow together or near by.

138. ***Astragalus atratus*** Watson Bot. King 69 t. 11 (1871). ~~Hamosa~~ Rydberg. *A. atratus* var. *stenophyllus* Jones, var. *arctus* Sheldon. Pods from base to tip more narrowed at base and distinctly stipitate in the calyx pendent at the end of an ascending or slightly reflexed pedicel, 2-2.5 cm. long, rarely 3 mm. high or wide, chartaceous, sulcate dorsally shortly acuminate, linear, about as in *A. obscurus* and septum as variable. Flowers whitish or dull-purple, about as in *A. obscurus*, but banner notched, about 1 cm. long, oval, arched abruptly to 60°-90° at calyx tips. Wings 2-lobed in the type, narrowly oblong, arched, longer than the keel. Keel strongly arched from the base, about 3 mm. long, the tip erect and tapering-acute and little produced. Calyx long-campanulate, nigrescent, rather hyaline, narrowed below, about 3 mm. long, 2 mm. high, not gibbous, reflexed or spreading, thrice as long as the subulate to triangular teeth. Fruiting pedicels 4-6 mm. long, very slender, often twisted very much longer than bracts. Racemes elongated, 5-10 flowered. Peduncles often a foot long and the rachis as much more, tapering and strict. Leaves rarely 1 dm. long, with 3-7 pairs of (in the type) nearly filiform acute leaflets scattered or even absent on the upper leaves, 2-15 mm. long. Pubescence ashy and minute. Stems very slender, with one to few slender internodes, rather many and tufted from the woody base, decumbent. This is the common form growing in the open. From Palisade, Nevada to Reno and probably southward to Death Valley, northward to the Snake river from Glenn's Ferry westward but not in the lower Columbia Basin proper. Growing in the sagebrush in gravelly soil in valleys and low slopes. Lower Temperate life zone. Blooms in May. The plants reported from Pine Valley Mts. Utah by Parry are *A. straturensis*. The species as described and figured by Watson in King's Report is misleading. The basis of the type is the material from the Toyabe and Pah Ute Mts. Nevada, but the figure represents what the artist thought the species was and not what it was, no such leaves are found on any specimens, and are an invention of the artist to represent what he thought the plant would be when fresh. This caused the writer to err in describing the var. *stenophyllus* as he took the figure to represent the species. Nelson's plant is the most slender and rarest form. The lobing of wings is very variable.

Astragalus atratus* var. *phyllophorus Jones Cont. 10 62 (1902). This is the normal well developed form of the species growing in moist soil. Pods abruptly acute and apiculate, about 3 mm. wide, inclined to be a little wider above, nearly round in cross section, appearing a trifle inflated. Wings about twice as long as keel and much wider above and rather deeply lobed, as long as banner. Flowers fully 1 cm. long. Keel tip incurved 100° and tip deltoid. Calyx 4 mm. long, barely gibbous, narrowed below, teeth broadly triangular, about one-quarter as long as tube. Pedicels 4 mm. long, three-fourths times the bracts. Peduncles rarely over 1 dm. long. Leaves 2-7 cm. long. Leaflets re-

mote, 4-10 mm. long, narrowly elliptical, obtuse. Austin, Nevada.

Astragalus atratus var. Owyheensis (Nelson). *A. Owyheensis* Nelson Bot. Gaz. 55 375 (1913). Pods papery, shaped about as in the type, broadly linear, acuminate, nearly straight, about 4 mm. wide, 2 mm. high and 1.5-2 cm. long, somewhat dorsally flattened and shallow-sulcate below, on a slender stipe varying up to the length of calyx tube from very short, on a twisted capillary pedicel often 1 cm. long, in very lax and elongated racemes on almost capillary peduncles often 2° long. Dorsal suture a mere ridge within, cross section about reniform, pod pendent, a little inflated, splitting to the middle along the dorsal suture and to the base of the ventral and valves twisting, about smooth and mottled, with sutures rather prominent but not much pedicels 4-6 mm. long, ascending. Banner nearly reniform, about 5 mm. thickened. Flowers dullgreenish-white, about 1 cm. long, on capillary long, thick, with sides a little reflexed above, abruptly arched to 100° at end of calyx tube, deeply notched. Wings as long as banner and much enlarged above but not notched or lobed to speak of, very obtuse and rounded and wide. Keel purple-tipped, wide, the blade about half as long as wings, acute but not produced. Calyx campanulate, rounded at base, equally inserted, about 4 mm. long, with triangular teeth about 1 mm. long or a little more. Bracts minute, ovate, hardly 1 mm. long. Peduncles subscapiform the proper stems being only a few inches long and very many from a slender and rather woody root which is much branched at tip as are the stems. Stipules hyaline, not connate, adnate, small. Normal leaves about 1 dm. long, the lower ones shorter, with tapering rachis and 3-5 pairs of distant leaflets which appear linear but are folded mostly and narrowly oblong and apiculate and about 1 cm. long, the uppermost one not jointed to rachis, but not elongated. Pubescence of fine hairs fixed by the base. The tufts lie flat on the ground and straggle along in the grass of the meadows forming loose mats often 3 feet in diameter in the most favorable places. First collected by me at Weiser, Idaho in 1900, then at Contact, Nevada in 1901 and in Oregon at Baker City in 1902. Because of its peculiar pod I was holding it to determine its true place in the genus when Nelson published it in 1913.

Astragalus atratus var. mensanus Jones Cont. 7 665 (1895). Pods narrowly oblong, about 2 cm. long and 3 mm. high, much laterally flattened, not sulcate dorsally, abruptly apiculate. Dorsal suture only a little intruded. Lower leaflets elliptical, upper linear. Darwin Mesa Inyo Co. California, Coville.

139. Astragalus lbapensis Jones Cont. 3 290 (1893). *Atelophragma* Rydberg. Pods about 12 mm. long and 3 mm. wide and high, round in cross section, abruptly apiculate, broadly linear, a trifle wider above, apparently with dorsal suture a little intruded, but not sulcate. Flowers about as in *A. atratus*, the wings rather fanshaped and about as long as banner and a little longer than keel which is straight along the base and then abruptly arched to 45°, rarely 90° and triangular acute and purple-tipped and about 3-4 mm. long. Calyx tube campanulate and equally inserted, 2 mm. long, ascending, the deltoid teeth hardly half as long, ashy. Slender pedicels about 3 mm. long and much longer than the minute ovate bract. Floral rachis not over 1 cm. long, zigzag, with 2-3 bracts. Peduncles about 3 cm. long, axillary in the 3-5 upper nodes. Leaves 3-4 cm. long, with petiole 1-2 cm. long and not tapering. Leaflets 1-5 linear-elliptical, the lateral ones 1 cm. or less long, obtuse, flat thin, petiolulate and jointed to rachis, the terminal one twice as long and not jointed to rachis, all the upper leaves reduced to the single terminal leaflets which are 2-3 cm. long and linear-acuminate, or with a minute side leaflet at the base. Stems almost filiform, about a foot long, simple, several from the crown of an erect and fleshy root. All but the lowest internodes 2-3 cm. long. Deep Creek (Ibapah) Utah on sagebrush plains. Lower Temperate life zone. No. 1084 Gooding from

Juab, Utah seems to be the same.

140. *Astragalus Panamintensis* Sheldon in Coville Death Valley Rep. 87 (1893). Pods about 1.5 cm. long, 3 mm. high and 2 mm. wide, fleshy when fresh with walls about $\frac{1}{2}$ mm. thick but cutting hard, coriaceous when dry, rather deeply sulcate along the middle but not at all at either end, with septum intruded nearly through below but not at tip, jointed to calyx and almost sessile, minutely purplish-mottled, faintly cross-ribbed, ashy, with ventral suture conspicuously thickened and raised, the tip straight and almost in the middle, cross section Y-shaped when dry, mostly single at the ends of the filiform peduncles. Flowers 1.2-1.5 cm. long, not broad, white, tipped with purple, banner oval-ovate, about 1 cm. long, abruptly arched to 90° at calyx tips, sides not reflexed, groove narrowly-V-shaped and extending to tip; white spot tridentate and oblong, waterlined only. Wings 2 mm. wide, 3 mm. longer than keel obliquely spatulate, convex to keel, expanded part mostly beyond keel, rounded, white below and purple above. Keel about 2 mm. long and high, arched to a half circle from very base, obtuse, bellied below. Calyx tube nigrescent, a trifle arched, the lower side barely concave and the upper side convex, not cleft deeper above, narrowly campanulate, about 4 mm. long and 2 mm. high, neither oblique nor truncate below. Teeth subulate and about as long. Pedicels 2-3 mm. long, slender. Twice as long as the ovate bracts. Peduncles weak, arched, 3-5 cm. long. Leaves 7-12 cm. long, with filiform rachis. Leaflets 4-5 pairs, 4-12 mm. long, linear to almost uniform, acute at both ends, rather falcate. Stems rather short and very slender, 4-15 cm. long with internodes 7-10 mm. long, woody at base, the tips erect. Pubescence of whole plant rather dense and hoary with short and appressed hairs. Growing in broad mats on cliffs. Lower Temperate life zone, in canons. Panamint Mts., California. The old stems endure from year to year and the old gray petioles help to give the whole a birdsnest appearance.

16 STRIGULOSI.

Pods chartaceous to papery, pendent (apparently ascending in *A. Tolucanus*), partly to fully 2-celled by the intrusion of the dorsal suture as a thin partition, rarely much sulcate dorsally, inclined to be wider above, linear to oval, stipitate (almost sessile in *A. reptans* and *Cobrensis*, and fully so in *platytropis*), inflated (scarcely so in *A. recurvus* and *straturensis*), with cross-section triquetrous to round, with ventral suture the more arched or if it is concave toward the end then the tip is declined (except in *A. Cobrensis*). Flowers about horizontal, small (large and 2 cm. long in *A. reptans*), rarely 1 cm. long, white or whitish (banner rarely purple), with campanulate calyx and triangular teeth mostly about as long as tube. Peduncles slender, at least as long as the leaves (sometimes shorter in *A. Tolucanus*). Leaves slender, short-petioled (long-petioled in *A. platytropis*), with rather many pairs of leaflets which are narrowly to broadly elliptical (sometimes linear in *A. Brandegei*), obtuse and mostly thin, nearly contiguous (except in *A. recurvus* and *Brandegei*). Stipules connate below (free in *A. straturensis* and *Brandegei*). Stems slender to filiform, decumbent to weakly erect (creeping and rooting in *A. reptans*), flexuous, with rather many internodes (almost none in *A. platytropis*). Tufted perennials (*A. Brandegei* is a winter annual) of the Middle Temperate to the Tropical life zones (*A. platytropis* appears as if subalpine). This rather loosely inter-related group is closely connected with the *Atrati* but lacks the very narrow rakish leaves and aborting leaflets and rigid petioles, etc. The species are all southern (except *A. platytropis*), reaching only to central Utah, growing among pine forests and junipers mostly and rarely in oak brush. *A. platytropis* grows in rich soil in coniferous open forests, and *reptans* seems to grow in rich and open warm meadows.

KEY

A. Pods linear, curved, papery, not inflated, not wider above, evidently stipitate, about 1.5 cm. long and 2-3 mm. high, triquetrous in cross-section, and sulcate dorsally. Flowers rather many, racemose, broad, about 7 mm. long. Calyx tube about 2 mm., acute at base, with teeth nearly as long as tube. Peduncles in the upper axils and about 1 dm. long and with floral rachis 1-2 dm. long in addition. Pedicels 1-2 mm. long, and nearly equaled by the ovate bracts. Leaflets narrow. Stems densely tufted and 1-3 ft. long, with rather many internodes 3-8 cm. long. **Recurvi.**

Pods convex along the ventral suture and so seeming wrong side up. Leaflets nearly linear, 5-8 mm. long. Wings only equaling keel. 141 *recurvus*.

Pods straight or slightly upcurved. Leaflets lanceolate or wider, 1-2 cm. long. Wings longer than keel. 142 *straturensis*.

2A. Pods oblanceolate to oval, inflated, shortly acute to apiculate, not over 8 mm. wide when broad, with cross-section round to oblate and inclined to be somewhat obcompressed, rarely sulcate and then very broadly so.

2AB. Flowers racemose, 3-8 mm. long.

2ABC. Flowers rather many, 5-10 cm. long. Pods linear-oblong, sulcate dorsally and obcompressed, acute, on a stipe at least as long as calyx, about 1.5-2 cm. long, little if at all wider above. 143 *strigulosus*.

2AB2C. Flowers 1-4, 3-4 mm. long, scattered along a filiform raceme, on long pedicels. Pods oblong-obconical, apiculate, on a minute stipe, wider above, about 1 cm. long. 144 *Brandegei*.

2A2B. Pods nearly globose to oval, conspicuously inflated, 2-3 cm. long, capitate. Stems slender, with imbricated stipules. 145 *platytropis*.

2A3B. Flowers in heads or very short spikes. Pods smooth, oblong, about 1.5 cm. long, cartaceous, evidently a little inflated. Leaflets broad or large.

2A3BC. Stems not creeping. Flowers not over 1 cm. long.

2A3BCD. Leaflets rather thick. Pods quite oblique, with upturned margins. Flowers white to cream-colored, 5-7 cm. long, with purple-tipped keel. Plants nearly erect, from slender root branches. 146 *Cobrensis*.

2A3BC2D. Stems very slender and nearly prostrate. Leaflets very thin. Pods scarcely oblique, stipitate. Banner purple-veined above and purple-tinged on the sides which are reflexed along the middle. Wings white-tipped. Flowers 1 cm. long, 10-20, in a dense oblong head which becomes a short spike in fruit. Keel purple-tipped.

Stems 2-3 ft. long. Flowers 1 cm. long. Calyx teeth subulate, 2-3 mm. long. 147 *Guatamalensis*.

Calyx teeth minute and deltoid. 148 *Painteri*.

Stems hardly 2 dm. long. Flowers 7 mm. long. 149 *Tolucanus*.

2A3B2C. Stems slender, decumbent. Leaflets thin, narrowly oblong, about 2 cm. long. Pods nigrescent, papery, 1 cm. long, nearly sessile, rather oblique. Flowers closely reflexed, spicate, about 4 mm. long. 150 *Rosei*.

2A3B3C. Stems creeping, and rooting at the nodes. Leaves long-petioled. Flowers cream-colored and reflexed. 151 *reptans*.

141 *Astragalus recurvus* Greene Bull. Cal. Acad. 3 155 (1885). Pods about 3 mm. high, sulcate nearly to the middle and with septum intruded almost to the ventral suture, with wavy margins, tapering into a stipe shorter than the calyx and triangular-acute with the tip following the curve of the dorsal suture which is conspicuously concave and the ventral very convex making the pod much recurved. Flowers dull-white. Banner oval, abruptly arched to erect at end of calyx, about 3 mm. long, with sides reflexed a little at base, the blade fan-veined with purple and with purplish sides much as in *A. obscurus*, barely surpassing wings and keel. Wings very obliquely obovate and about 3 mm. long and 2 mm. wide, whitish at tip, arched till tips are nearly erect. Keel arched from base to a half circle and with the triangular and acutish tip erect, or the whole keel nearly erect and triangular, about 3 mm. long and high, darker at tip. Calyx tube equally attached on pedicel and not oblique. Peduncle and floral rachis about equal. Leaves hardly 1 dm. long. Leaflets distant, about 8 pairs, about linear, 5-8 mm. long. Stipules connate. Stems about a foot high, decumbent below, minutely pubescent. This was first collected by Palmer at Prescott. It grows in the open pine forests of the Mogollons of northern Arizona from Prescott to Flagstaff and the Grand Canon. Middle Temperate life zone. Blooms in summer.

142 *Astragalus straturensis* Jones Cont. 8 19 (1898). Pods arcuate upward or straight, but the tip with a convex hump along the ventral suture and declined, papery, about 2 mm. high and 3 mm. wide, with cross-section rather oblately deltoid-reniform, rather abruptly contracted at base into a stipe at least as long as calyx, and abruptly and very obliquely apiculate at tip, sulcate to the middle and with the septum extended to the ventral suture which is not wavy on the margin. Flowers in racemes which are often twice as long as the peduncle, many, with deep-purple banner, white wings and purple-tipped keel. Banner broadly ovate, about 4 mm. long, notched, abruptly arched at calyx tips to 45 to 60 degrees, streaked with heavy purple lines within which are lighter on the outside; groove broad and shallow and about a third of a circle at base and nearly vanishing above; white spot hardly evident except when color is deep; sides of banner reflexed 1 mm. wide below and but little above. Wings arched at keel tip to 45 degrees, oblong-ovate, barely acutish, darker below, about 3 mm. long and 1 mm. shorter than banner and 1 mm. longer than keel, 1-2 mm. wide, concave to keel, one is vertical, the other horizontal and spreading. The keel extends about 2 mm. beyond calyx, arched to about two thirds of a circle, short-triangular, acutish, with straight base. Calyx tube nearly hemispherical, not gibbous, a trifle flattened above, slightly unequally attached. Fruiting rachis often a foot long. Leaves about 1 dm. long. Leaflets about 6 pairs, normally elliptical to lanceolate (rarely some of the lower ones oval), obtuse to retuse, generally folded, 1-2 cm. long, long-petiolate, cuneate at base, lighter below, appearing as if glaucous, almost smooth. Stipules triangular, green, reflexed, not connate, small. Stems often 3 ft. long and straggling, slender, nearly simple from an open base, with internodes 2-7 cm. long. This grows in the Pine Valley mountains Utah, among oak brush, on southern slopes, blooming in May, Middle Temperate life zone. It is possible that this is an extreme form of *A. strigulosus* var. *brevidentatus*.

143 *Astragalus strigulosus* H.B.K. Nov. Gen. & Sp. 6 494 (1824). pods about 4 mm, wide, about 2 cm. long in the type, triangular-acute at both ends and with a flat deltoid beak ending in the long subulate style, variably pointed, inclined to be ashy, speckled, with dorsal suture somewhat intruded. Flowers rather densely racemose, even spicate seemingly when young, many in the type, whitish, and inclined to be yellowish when dry. Banner almost round, about 3 mm. long, abruptly arched to erect or more at end of calyx tube, and thus even the keel seems to protrude beyond it, with sides much reflexed. The wings linear-oblongate, wavy, narrowed at tip, almost acute, about 1 mm, wide, much narrower than keel, fully as long as banner and

somewhat ascending, connivent at tip, much longer than keel. keel about 1 mm. longer than calyx, with straight or slightly arched base, and tip abruptly rounded to more than erect so that the deltoid acute apex does not seem at the end, it is also a little darker. Calyx, in the type, about black with dense and appressed hairs, rather gibbous, and the tube rather long-campanulate, about 3 mm. long, deeper and broadly cleft above, the triangular teeth half as long as tube or a little more, the lower the longer. Fruiting pedicels 2-5 mm. long, nearly equaled by the subulate bracts. Peduncles 1-2 dm. long, rather stout, with the floral rachis rarely 1 dm. long, but often 2 dm. long in fruit. Leaflets broadly to narrowly elliptical, obtuse to retuse, 8-12 pairs, 2 cm. long or less, loosely strigose-pubescent with spreading fine hairs. Lower stipules connate, reflexed above. Stems ascending to erect, very sulcate, about 2 ft. high, rather coarse. Plants growing in gravelly meadows in the forests. Middle Temperate life zone, from southern New Mexico southward throughout Mexico and westward to the Sierra Madres.

Astragalus strigulosus var. gracilis Hemsley Bot. Cent. Am. 1 266 (1880). This is a less pubescent form with rather few oblong pods and with racemes rarely over 5 cm. long, and shorter peduncles and slender stems. This is the more common form northward.

Astragalus strigulosus var. brevidentatus Hemsley l. c. A. Rusbyi Greene. This is an almost smooth form with linear pods about 3 cm. long, uncolored and smooth, with loosely racemose flowers about 5 mm. long. Calyx teeth deltoid and a third to a fourth the ashy tube. Leaflets oval to narrowly elliptical, rarely 1 cm. long. Frequent in the San Francisco forest of northern Arizona and eastward to the Sacramento mountains of New Mexico, southward to central Mexico. It seems quite distinct but intergrades freely with the other forms.

144 **Astragalus Brandegei** Porter Fl. Col. 24 (1874). Pods papery, rounded at tip, appressed-hoary to puberulent, reflexed but appearing ascending when the peduncles are prostrate, very few and widely scattered, 1-1.5 cm. long, 4-7 mm. wide, about 3 mm. high, very shallow-sulcate, narrowed below, filled with the few large seeds, with uneven sides due to the bulging sutures, neither suture prominent but the dorsal straight and pod flat on that side, the ventral suture arched, cross-section a flattened oval, septum not quite complete toward the tip. Flowers white. Banner arched abruptly at end of calyx teeth to 90-100 degrees, oval, 1 mm. longer than keel, 4 mm. long, about 3 mm. wide, deeply notched, the groove forming a very broad arc of a circle and with a fine cleft along the middle, sides reflexed for about one half mm. wide on the margins so that the banner is almost taken up by the groove which is 2 mm. wide and goes to the base of blade. The wings oblong-ob lanceolate, broad, arched to 60 degrees, a trifle longer than keel and concave to it, the left hand one flaring and the other one folded over the keel's end. Keel very short, straight, with tip sharply incurved to 135 degrees, barely surpassing calyx, 2 mm. high, with the purple tip erect and produced but barely acute. Calyx tube turbinate, hairy, a little shorter than the subulate and spreading teeth, not over 2 mm. long. Pedicels slender, 4-7 mm. long. Bracts minute and ovate. Peduncles erect, flexuous, much longer than the leaves, 1-2 dm. long, filiform and weak. Leaves 5-7 cm. long, very lax and with distant leaflets which are linear but appear filiform (because they are folded), about 5 pairs, involute, smooth above, 1-2 cm. long. Stipules adnate, apparently free, green, large for the plant. Stems densely caespitose and much branched at very base, prostrate, almost filiform, many, straggling outward a foot or two, flexuous, from slender, erect roots. This is one of the most delicate Astragali. It grows in sand, gravel, and clay, abounds under oak brush on the slopes of the Wasatch plateau and grows luxuriantly in abandoned fields in open places in poor clay soil. Middle Temperate life zone, and running down along streams into the Lower. From Canon City Colorado to the Wasatch plateau and southward to the Mogollons New Mexico. It is in bloom in June. This species has the same prolix habit of the last var. of *A. atratus*.

145 **Astragalus platytropis** Gray Proc. Am. Acad. 6 526 (1865).

Pods dark-puberulent, sometimes smooth when ripe, mostly mottled, oval to oblong-oval, very thin and papery, a little obcompressed when fresh, rounded at both ends, shortly apiculate at tip, not oblique, with dorsal suture the more arched, a little sulcate at both sutures, straight, completely 2-celled by papery partition, with cross-section oval. Flowers dull-white to lead-purple, about 7-8 mm. long. Banner dirty-white and tinged with yellow, or varying to light-lead-purple, bent abruptly at calyx tube to 45 degrees, concave, hooded at tip by the contraction of the groove, about 7 mm. long, a trifle wider below but about round, notched at midrib and often with additional ones at tip on each side; groove very broadly V-shaped; sides reflexed a little, purple-veined opposite the calyx mouth. Wings arched and exposing the whole keel, obliquely lanceolate-oblong, obtuse, turned out and horizontal so that they form with the keel the letter T. Keel broad, with straight base and then abruptly erect and 3 mm. high, the tip truncate and purple, about as long as banner and wings or about 1 mm. shorter. Calyx tube campanulate, about 2 mm. long, nigrescent, the teeth subulate and a little shorter than the tube. Pedicels very short to 2 mm. long. Bracts mostly longer than the pedicels, ovate to lanceolate, minute. Peduncles scapose, filiform, 3-8 cm. long, capitate few-flowered. Leaves 3-8 cm. long, narrow, much as in *A. calycosus*, the petiole mostly longer than the rachis. Leaflets 3-6 pairs, 7-10 mm. long, elliptical to obovate, acute to apiculate. Stipules ovate, acuminate, large. Stems almost none, densely small-tufted, from a thick, fleshy, very long root. Pubescence silvery-silky. This grows in gravel on dry and rocky ridges for the most part, from the Upper to the Middle Temperate life zone. Rare. Sonora Pass Cal., Brewer; Beaverhead Co. Mont, Tweedy; Aurum and Sprucemont Nevada and Mt. Ibapah Utah, Jones.

146 **Astragalus Cobrensis** Gray Pl. Wr. 2 43 (1853). Pods oblong, 1-1.5 dm. long, 4-7 mm. wide, about 2-3 mm. high, chartaceous, almost sessile, abruptly rounded at both ends, conspicuously obcompressed, convex to near the tip and concave at the tip, sulcate dorsally and the ventral suture somewhat raised and rather thick, septum a little produced. Flowers rather many, densely short-spicate but the fruit racemose though the fruiting rachis is rarely 5 cm. long. Banner oval, abruptly arched at end of calyx teeth to 45-90 degrees, 3-4 mm. long, a little longer than wings, with sides reflexed about a half mm. wide. Wings oblong-obovate, a little arched, 1-2 mm. wide, about 1 mm. longer than keel. Keel abruptly incurved to nearly a half circle, obtuse, wide. Calyx not oblique, nigrescent, 1-2 mm. long, broadly campanulate, acute at base, equally inserted, the subulate and curved teeth fully as long as tube. Pedicels 1-2 mm. long, stout, about as long as the rigid and triangular bracts. Peduncles hardly as long as the leaves, rather stout, 10-15-flowered. Leaves 4-10 cm. long, Leaflets 6-10 pairs, 5-10 mm. long, nearly contiguous, about oval-obovate and mostly notched flat, about smooth. Stipules connate below. Stems hardly a foot long, erect, flexuous, with internodes shorter than the leaves, several from a much branched and slender root. Pubescence minute and appressed. This species grows in sandy soil among junipers, Lower Temperate life zone from the Catalina Mts. Arizona to the Cobres of New Mexico and southward to Coahuila.

147 **Astragalus Guatamalensis** Hemsley Bot. Cent. Am. 1 264 (1880). Pods oblong, about 1.5 cm. long, 7 mm. wide, 4 mm. high, obcompressed, deeply sulcate dorsally, nearly 2-celled, with septum intruded about one half mm. wide as a thin edge, pod a little concave in middle along the ventral suture but convex at both ends with the short apiculation in the middle of the end or a little below it and rather declined, abruptly contracted at both ends, (in the type) on a stipe much shorter than the calyx, finely cross-nerved, rather coriaceous. Banner about 8 mm. long, oval, abruptly arched at end of calyx to 45 degrees, 2-3 mm. longer than wings. Wings oblong, rather narrowed above, a

trifle arched, about 1 mm. wide and 1 mm. longer than keel. The keel straight, about 4 mm. long, then abruptly erect, triangular and acutish and about 3 mm. high. Calyx tube about hemispherical, 3 mm. long and wide, appearing inflated, rounded at the fleshy base and about equally inserted, cleft deeper above but barely oblique above, the sinuses very broad, and the subulate teeth about 2-3 mm. long and very slender, nigrescent. Pedicels in flower stout and very short, longer than the very papery, white and subulate bracts, but becoming 2-3 mm. long and even slender in fruit. Peduncles nearly filiform, spreading, often a foot long. Leaves about 1 dm. long, weak, with lax and tapering petioles and rachis, widely spreading. Leaflets 12-15 pairs, elliptical, truncate to notched at tip and apiculate, 7-10 mm. long and about half as wide, minutely pubescent along the margins and midrib. Stipules very thin and papery, subulate, about 1 cm. long or less, united below. Stems 2-3 ft. long, straggling upward and rather freely branched. This grows in barrancas (canons) in the mountains in rather moist places from Oaxaca and Hidalgo Mexico to Guatamala in the Middle Temperate life zone. It is probably *A. bidentatus* H.B.K. a very uncertain species because only the figure remains to represent the species, and we know that these were not always accurate in some cases of well known species.

Astragalus Guatamalensis var. Oaxacanus (Rose) Jones. *A. Oaxacanus* Rose in herb. This is a form with smooth, oblong-oval pods on a stipe longer than the calyx. Bracts triangular, 5-8 mm. long. Leaflets elliptical to narrowly oblong-ovate, often ashy. This is Pringle's No. 6264 from Oaxaca. It has the same elongated and slender stems which are decumbent, broad leaflets, and blunt pods of the type. It is the common form in Mexico from the states of Hidalgo, Mexico, and Oaxaca.

Astragalus Guatamalensis var. Lozani (Rose) Jones. *A. Lozani* Rose in herb. Stems a foot high, ascending, slender, freely branched, from underground branches of the root. Leaves 5-7 cm. long, with about 10 pairs of small leaflets which are oval to elliptical and rarely 2 cm. long. Internodes 2-5 cm. long. Pods the same as in the other variety but ashy as well as the whole plant. Bracts hardly as long as the calyx tube. Sierra de Pachuca Hidalgo Mexico, Pringle's No. 6935 July 28 1898, 9000 ft. alt. Middle Temperate life zone. The type is the National Herb. No. 462652. Also collected by Nelson in Oaxaca, No. 1940, Nov. 12 1894. Zacatecas Mexico, Rose, Aug. 26 1897, Nat. Herb. No. 301562.

Astragalus Guatamalensis can be separated from extreme forms of *A. strigosus* only by the flowers being in heads, and by the broader and blunt pods. It is described as having sessile pods without partition and with creeping stems, but this not true of the specimens cited by the author in his description. Both species have the narrow septum going part way across from the dorsal suture.

148 Astragalus Painteri Rose in herb. This is like the preceding species but the calyx teeth are minute and de'toid and about a quarter as long as tube, stipules subulate and not at all connate. Pods opening only along the dorsal suture, about 1.5 cm. long, oblong-oval, truncate at base, abruptly apiculate-acute at tip, much obcompressed and broadly sulcate dorsally but not at all ventrally, smooth, strongly cross-nerved, inflated, chartaceous, with septum intruded about a half mm. high. Ventral suture much thickened, raised and white. Stipe a little, shorter than calyx. Flowers white but purple-tinged, about 1 cm. long, in heads and soon reflexed. Banner oval, about 5 mm. long, arched to 45 degrees beyond calyx tips, with sides reflexed 1 mm. wide in the middle, about 1 mm. longer than wings. Wings arched a little, lanceolate, about 2 mm. wide in the middle, 2 mm. longer than keel. Keel half-rhomboidal, very obtuse, about 3 mm. high, purple tipped. Calyx about hemispherical, 3 mm. long, rounded at base and inserted near the corner, minutely nigrescent, about twice as long as the triangular and white bracts. Teeth variable but mostly very short.

Peduncles slender, strict, about 1 dm. long, a little longer than leaves. Leaves about 1 dm. long, the upper nearly sessile, with 10-12 pairs of elliptical-ovate leaflets which are about 1 cm. long, obtusish, flat, not contiguous, smooth or rarely ashly. Stems 3-5 ft. long, prostrate or ascending, with slender internodes 3-5 cm. long, (shorter in smaller plants), flexuous. Stipules hyaline and conspicuously connate. Sierra de Ajusco Morales Mexico, May 26 1898, Middle Temperate life zone, Pringle's No. 6861, Nat. Herb. 462653. It was also got by Nelson in the valley of Oaxaca Sept. 20 1894 No. 1427 in the Lower Temperate life zone. This form has peduncles 2-3 dm. long, 15 pairs of leaflets, stipules 1 cm. long, flowers short-spicate. Other localities by Rose are Tres Marias Morales July 4 1901 No. 395071, and El Parque Morales Sept. 21 1903 No. 450817.

149 **Astragalus Tolucanus** Rob & Seat. Proc. Am. Acad. 28 104 (1893). Pods about 1 cm. long, rounded at both ends, oblong-oval, little if at all sulcate, on a tapering stipe about as long as calyx, apparently membranous, probably pendent on the reflexed stipe and spicate, with septum a little intruded. Flowers about 20, ascending. Banner ovate to oblong, about 7 mm. long, gently arched to erect from the end of calyx tube, about 2 mm. longer than wings and 5 mm. longer than keel. Wings about 1-2 mm. wide, narrowly oblong, ascending, concealing keel. Keel with straight base, barely 3 mm. long, thick, the tip abruptly erect and almost square and 2 mm. high. Calyx tube campanulate, about 4 mm. long and 3 mm. high, nearly truncate at base and a little unequally attached, hyaline and speckled with minute and black hairs, cleft deeper above and with teeth unequal but broadly triangular and nearly as long as tube. Pedicels slender, 2-3 mm. long, much shorter than the rather stalked, ovate, foliose bracts which often equal the calyx but are rather hyaline below and 4-10 mm. long. Peduncles mostly shorter than the leaves, stout for the plant, sulcate, as thick as the stems. Leaves 4-6 cm. long, very short-petioled, lax. The Leaflets 8-15 pairs, oval to oblong-elliptical, 4-7 mm. long, smooth above, inclined to be broader below and with cuneate base. Stipules conspicuous, hyaline, the upper the largest, lanceolate, about 7 mm. long. Stems weak and filiform, very many, from a thick crown, hardly 2 dm. long, branched, nearly prostrate. Internodes about 2 cm. long. Whole plant nearly smooth except the nigrescent calyx and bracts. This is a delicate and low plant related to *A. Guatamalensis*. Middle Temperate life zone, growing among pines on mountain sides in the Nevada de Toluca state of Mexico. The broad calyx lobes and bracts are peculiar.

150 **Astragalus Rosei** N. Sp. Pods about 3 mm. high and 4 mm. wide, closely reflexed, convex along both sutures, specially at tip and base, obtuse at both ends, but strongly apiculate at tip, somewhat inflated, oblong, the ventral side rather triquetrous, the dorsal flattened a little and very broadly sulcate along the middle making the cross-section triquetrous-reniform, the septum little intruded as a very thin partition. Flowers stubby, purplish. Banner very broad and much recurved, not over 4 mm. long, often surpassed by the wings which are narrowly-oblong and somewhat longer than the keel. Keel obliquely ovate and about 3 mm. high and erect or arched to a half circle, obtuse, conspicuous. Calyx campanulate, the tube 3 mm. long, cleft deeper above, with the lower side straight and the upper arched and inserted near the lower corner, nigrescent with very short and close-pressed hairs. Teeth subulate from a deltoid base, about half as long as tube. Bracts lanceolate, hyaline, 4-5 mm. long. Pedicels almost none. Peduncles slender, 6-10 cm. long, in the upper axils, the floral rachis 3-5 cm. long. Stems flexuous, a foot or so long, probably perennial. The leaves about 1 dm. long, nearly sessile, with about 10 pairs of oblong, rounded and rather long-petiolulate leaflets which are nearly smooth. Stipules about 5 mm. long, triangular, free above. This has the habit and general appearance of *A. Brandegei*, but the pods have the general shape and look of the *Guatamalensis* group, though they are nearly

sessile. Above Dos Rios in the state of Mexico, Sept. 4 1904 by Rose and Painter, Nat. Herb. No. 450372.

151 **Astragalus reptans** Willd. Hort. Berol. 2 88 t. 88 (1816). Pods oblong-oval, about 1.5 cm. long, 7 mm. wide, rounded and abruptly apiculate at tip, almost sessile and splitting the calyx, inclined to be a little wider above, scarcely oblique, little if at all sulcate, a little obcompressed, but cross-section nearly round, partly 2-celled. Flowers in a short spike and closely reflexed, cream-colored at least when dry, about 1.5 cm. long, rather many. Banner oblanceolate, obtuse, about 1 cm. long, but little arched, 1 mm. longer than wings, with sides reflexed about 1 mm. wide. Wings oblanceolate, obtuse, 2 mm. wide, narrowed above, about 4 mm. longer than keel, straight. The keel obtuse, about 2 mm. wide, 4 mm. long, not colored, with the erect tip straight. Calyx tube short-cylindric, about 5 mm. long, 3 mm. wide, equally attached, with the lower corner cut off, very oblique below, thin, nigrescent: teeth triangular from a deltoid base, over half as long as tube, unequal, with narrow sinuses. Pedicels very short. The bracts are papery as in *A. Guatamalensis*, ovate to lanceolate, barely acute, 2-3 mm. long. Peduncles about a foot long, slender, from rooting nodes. Leaves 1-1.5 ft. long, slender, with petioles nearly as long as the rachis. Leaflets smooth, narrowly elliptical, cuneate below, about 2 cm. long, thin and flat, 12-14 pairs, contiguous, 3-7 mm. wide, obtuse. Stipules large, connate-falcate, green. Stems 2-4 ft. long, creeping and rooting at the nodes, many, with internodes 4-10 cm. long. This grows on knolls in low meadows, valley of Mexico and Sierra de Las Cruces. Middle Temperate life zone.

71. FLEXUOSI.

Pods coriaceous (rarely papery in *A. Sileranus*), rather fleshy when fresh, corrugated or cross-ribbed, with both sutures rather thick and prominent externally but not intruded (sometimes a little intruded in *A. Sileranus*), wholly 1-celled, oval to nearly linear, oblique, horizontal to reflexed on rather stout, and short pedicels, inclined to be sulcate ventrally and sometimes dorsally, variously inflated (scarcely so in *A. flexuosus* and *parviflorus*). Flowers purple, racemose, with campanulate or rarely short-cylindric calyx and short teeth. Leaves wide, nearly sessile. Leaflets 3-10 pairs, narrow to elliptical, rather distant and long-petiolulate, thick and folded, mostly retuse and about 1 cm. long (rarely more). Pubescence ashy throughout with minute, appressed hairs fixed by the base and often tangled, the surface of the leaflets also roughened. Stipules connate below, broad, rather small. Stems slender, decumbent, much branched from the much branched crown of the erect and rather slender root. Perennials of the Lower and Middle Temperate life zones, growing in gravelly soil in dry places. The natural place for this group is just before the Collini but in a linear arrangement it comes here.

KEY

A. Flowers small. Calyx campanulate. Pods small or nearly linear, rarely 3 mm. wide, cross-ribbed, scarcely inflated, about sessile. This approaches the *A. sophoroides* group in the pods but differs much in flowers and foliage.

AB. Pods boat-shaped, hardly twice as long as wide, strongly cross-ribbed, inclined to be bisulcate ventrally, much obcompressed, reflexed on twisted pedicels which are as long as or longer than the bracts, the ventral suture about straight and the tip in line with it. 152 *parviflorus*.

A2B. Pods narrowly oblong, 3-4 mm. wide or high, sometimes a little wider above, with cross lines faint and fine or pod minutely reticulated, walls thin-coriaceous. Pedicels slender, longer than the bracts, reflexed. Flowers about 1 cm. long. Calyx tube about 3 mm. long.

Pods short-stipitate, about smooth, higher than wide, ventral suture not convex. Peduncles longer than leaves. 153 *flexuosus*.

Pods sessile, ashy, 3 mm. wide and high, ventral suture conspicuously convex. Pedicels shorter than leaves. 154 *Diehlii*.

2A. Flowers large, bright-purple 2-3 cm. long. Calyx short-cylindric, attached by the lower corner, very oblique at tip and truncate below.

2AB. Pods large, 2-3 cm. long, evidently inflated, mostly 1 cm. wide or high, very oblique, pendent, in short racemes.

Stems sparingly branched and straggling upward, 1-2 ft. high.

155 *gracilentus*.

2A23. Pods cylindrical, acute, about 2 cm. long, little oblique or much inflated, arcuate, sessile.

156 *coriaceus*.

2A3B Pods not cylindrical.

Pods straight, ovate, stipitate.

157 *Antoninus*.

Pods oblanceolate.

158 *pinonis*.

Pods immature and very hairy.

159 *Neomexicanus*.

3A. Slender and prostrate plants with nearly simple stems 2-3 ft. long. Leaves distant, nearly sessile, divaricate. Peduncles long and divaricate. Flowers capitate. Pods rigid, 1-2.5 cm. long.

160 *Sileranus*.

152 *Astragalus parviflorus* (Pursh Fl. 474 as *Dalea*) MacMillan *Metasperm.* 325 (1892). *A. microlobus* Gray. Pods about oval, triangular-apiculate, about straight, 5 mm. long, by 3 mm. wide, barely 1 mm. high, in long racemes, reflexed, on pedicels about 1 mm. long. Flowers pale barely 4 mm. long, many. Banner oval, abruptly bent at end of tube to erect, 3-4 mm. long, with sides reflexed most above. Wings oblanceolate, rounded, flaring, concave to keel and arched to 45 degrees, longer than keel, but much shorter than banner. Keel arched from base to a half circle and obtuse, barely 2 mm. long. All petals with exerted claws. Calyx hemispherical, about 1 mm. long, with deltoid teeth less than a third as long as tube. Peduncles 1 ft. or so long, narrower than the stems, rather appressed as well as the leaves, with flowers racemosely spicate on the upper half and appressed till nearly mature then flowers spreading to reflexed. Leaves rarely 7 cm. long, with 2-4 pairs of narrowly linear leaflets nearly 2.5 cm. long. Stems weakly erect, almost filiform, 1-2 ft. long, with rather long internodes. Park Co. Montana to Kansas, Minnesota and Missouri on prairies and plains, in May and June.

Astragalus parviflorus var. *microlobus* (Gray Proc. Am. Acad. 6 203 1864 as species). This is a more robust and more branched form with pods often 8 mm. long, 3-5 mm. wide and 2 mm. high, and a little longer and narrower and somewhat arched and less obcompressed, the calyx tube is about 2 mm. long, the flowers 7-8 mm. long and the banner purple-striped. Leaflets 4-8 pairs, oblong to broadly linear or oblanceolate, rarely over 1 cm. long, mostly notched. Stems rather spreading or subdecumbent and widely branched. This is the common form central Montana to southwestern Kansas and Colorado, in the foothills on the Atlantic slope in Colorado.

253 *Astragalus flexuosus* Douglas in Hook. Fl. Bor. Am. 1 141 (1830). Pods 1-2.5 cm. long, short-stipitate, rather rugulose, about smooth, in the type nearly round in cross-section or a little higher than wide, rather wider above, the ventral suture straight and not sulcate, the dorsal suture little or not at all sulcate, the triangular tip rarely 1 mm. long and is also straight and in line with the ventral suture. Flowers often purplish, in loose and rather short racemes. Banner oblong, abruptly arched beyond calyx teeth to 45-90 degrees, not over 7 mm. long. Wings nearly as long as banner, arched, narrowly oblong, obtuse. Keel about 2 mm. shorter than wings, 3 mm. long, 1 mm. wide, with straight base and then abruptly arched to erect at the obtuse tip which is purple and 2 mm. high. Calyx tube about 3 mm. long, triangular-campanulate, very oblique at tip, equally inserted, ashy or nigrescent, teeth deltoid or triangular, rarely one fourth as long as tube. Pedicels 1-2 mm. long, rather longer than the ovate bracts. Peduncles 1-3 dm. long. (the rachis often as much more in fruit), longer than the leaves, slender, somewhat spreading, in all but

the lowest axis, tapering. Leaves 5-7 cm. long, about twice as long as the internodes, nearly sessile. Leaflets rather truncate to notched, mostly linear-cuneate, sometimes cuneate-oblong, the upper pairs on the rachis a little shorter, 8-10 pairs, about 1 cm. long, rarely 2 cm. long, long-petiolulate, subalternate, thickish, the upper sides less pubescent. Stems 1-2 ft. high, flexuous, bushy-branched, inclined to be decumbent, very open, from slender and often underground root branches. Stipules rigid, triangular, reflexed, the upper about 5 mm. long. The type is the common form from Colorado and central New Mexico in the Sierra Blanca and northward to the Saskatchewan and Nebraska on dry foothills and prairies. It also occurs on the Pacific slope at Durango Colorado (Diehl). Middle Temperate life zone. This varies toward *A. gracilentus* at the south but flowers smaller and pods rarely inflated.

Astragalus flexuosus* var. *elongatus (Hook. Fl. Bor. Am. 1: 140 1830 as *Phaca*). Pods sulcate at both sutures, conspicuously tapering and much obcompressed at base, arcuate, barely 3 mm. wide. Flowers smaller and white. Leaflets cuneate-oblong. This is the common form from Montana northward, though sporadic plants occur through the entire region.

Astragalus flexuosus* var. *Fendleri (Gray) Jones Cont. 10: 62 (1902). *Phaca Fendleri* Gray Pl. Fend. 36 (1849). Pods straight, rather larger above, with both sutures convex and about equally so, tapering at base, smooth, on a stipe half as long as the calyx, rather rounded at tip and apiculate, with chartaceous walls, few, mostly in short racemes, about round in cross-section, a little sulcate, pendent. Flowers purple. Calyx lobes minute. Leaflets elliptical to narrowly oblong. Glenwood Springs to Salida and southward to Durango Colorado among junipers. Upper edge of the Middle Temperate life zone.

154 *Astragalus Diehlii* N. Sp. Pods 1-1.5 cm. long, sessile, pendent, oblong, ashy, about 3 mm. wide and high, about straight or the dorsal suture a little concave, obtuse at both ends or only triangular-apiculate at tip, rarely a trifle narrower below, cross-section obovate to a little cordate, ventral suture conspicuously convex (the pods appearing wrong side up), the tip in line with the dorsal suture or nearly so, surface ashy. Flowers about 7 mm. long, light-colored. Peduncles shorter than the leaves and mostly half as long as the floral rachis but rarely forms occur with longer peduncles. Leaves about 5-7 cm. long. Leaflets 5-9 pairs, cuneate-linear, 1-1.5 cm. long. Stems very tortuous, from slender underground branches of the thick and woody crown of the strong and erect root. Adobe plains at Farnham Utah as to the type. Lower Temperate life zone. This may be only an extreme form of *A. flexuosus*.

155 *Astragalus gracilentus* Gray Pl. Fend. 36 (1849) as *Phaca*, and Proc. Am. Acad. 6: 223 (1864). Pods sessile, half-elliptical, 1.5-1.8 cm. long, 4 mm. high, 3 mm. wide just below the middle, finely reticulated, little rugulose, shortly acuminate and apiculate, not sulcate, minutely hairy, with cross-section triangular-ovate, the ventral suture straight or nearly so and tip in line with it, splitting the calyx and rounded at base, on pedicels about 2 mm. long, and with minute bracts on the rachis. Flowers about 1 cm. long, shortly racemose, ascending when young. Banner oval, about 5 mm. long, abruptly arched to erect at end at calyx teeth and 2-3 mm. longer than keel. Wings narrow and a little longer than keel. Keel with straight base, then abruptly erect and 3 mm. high, about 4 mm. long, the tip triangular and apiculate. Flowers rather stubby. Calyx tube 3 mm. long, the triangular and very unequal teeth about half as long as tube, cleft much deeper above, slightly oblique at base, half as wide as long, ashy with slightly spreading hairs. Peduncles about as long as leaves and equaling the fruiting rachis. Leaves 5-7 cm. long. Leaflets 6-8 pairs, notched and rounded, cuneate-oblong, about .5-1 cm. long. Stems slender from a woody base. Mountains of New Mexico about Santa Fee. Middle and Lower Temperate life zones, blooming April to May, fruiting in

June.

Astragalus gracilentus var. Hallii (Gray) Jones Cont. 8 13 (1898). This differs from the type in having the pods wider above and more inflated, smoother, rather clavate-oblongate, 5-7 mm. wide, about 2 cm. long, with ventral suture straight or concave near the narrowed base, and variably convex at tip, little laterally flattened or rarely round in cross-section, distinctly stipitate, coriaceous to chartaceous. Flowers and pods inclined to be short-spicate to almost capitate, the flowers about 1.5 cm. long, stubby, with calyx tube about 5 mm. long and 4 mm. high, and with minute deltoid teeth. Twin Lakes and the Sangre de Cristo mountains Colorado and San Francisco mountains Arizona. Middle Temperate life zone.

Astragalus gracilentus var. Greenei (Gray) Jones Cont. 8 14 (1898). Pods strictly sessile, with minute and spreading hairs, splitting the calyx, 1.5-2 cm. long and nearly 1 cm. wide and high, broadly sulcate ventrally, oval to oblong-ovate, conspicuously inflated, faintly cross-ribbed, with a triangular, flat and stout beak. Flowers shortly-racemose, 1-1.5 cm. long, as in the type but the calyx teeth subulate and half as long as tube. Leaflets broadly oblong, rounded, about 5 mm. long. Peduncles longer than the leaves. Whole plant ashy, and the stems and peduncles almost white. Mogollons New Mexico, blooming in April. The type of this form is in the Gray Herbarium and duplicate material is in my herbarium and a few others but variously mixed since Greene did not know one form from the other confusing fallax forms with it. All of the mature plants and most of the pods he distributed are fallax.

Astragalus gracilentus var. exsertus N. Var. This is a very remarkable form with few flowers about 2 cm. long, brilliant-purple, strongly striped and with exserted claws. The oblong banner is nearly 1.5 cm. long with sides much reflexed below, slightly and abruptly arched beyond the calyx tips to 30 degrees, about 2 mm. longer than wings. Wings 2 mm. wide, a little arched and obtuse, purple-striped, 3-4 mm. longer than keel. Keel straight, forming nearly a half circle, 4 mm. long, and 3 mm. high, the tip erect and triangular, light-colored. Calyx tube about 5 mm. long and 3 mm. high, about as long as the subulate teeth. Bracts much longer than the short and stout pedicels, 4 mm. long. Pods about 2 cm. long, 1 cm. wide and high, sulcate ventrally, strongly cross-ribbed and almost cartilaginous, oblong, sessile, splitting the calyx, the stout and flat beak upcurved and about 4 mm. long. Ventral suture straight, dorsal suture much arched, cross-section rather obcordate. Leaflets 6-12 pairs, cuneate-oblong, notched, fully 1 cm. long. Whole plant minutely woolly. Stipules green, nearly linear, almost 1 cm. long. Trinidad Colorado, No. 7 Geo. E. Osterhout, 1898.

Astragalus gracilentus var. fallax (Watson) Jones Cont. 8 14 (1898). Pods obliquely oblong-oval, to ovate, about as in the preceding variety but ventral suture rather convex above and not sulcate, pods short hairy, abruptly stipitate the stipe being nearly as long as calyx. Flowers much as in the type but about 1.5 cm. long, and stubby. Banner oval, about equaling the wings and not much longer than keel. Calyx teeth rudimentary, deltoid, the tube inserted at right angles to the pedicel, very oblique on the lower side and convex above, about 5-7 mm. long. Peduncles stout, much longer than the leaves. Leaflets 3-15 mm. long, cuneate-oblong to nearly linear. Stipules and bracts very broad and very short. In the pine forests of the San Francisco plateau of northern Arizona, on gravelly mesas. Middle Temperate life zone. It blooms in summer.

Astragalus coriaceus Hemsley Bot. Cent. Am. 1 263 (1880). Pods arcuate, cylindrical, about 2 cm. long and 7 mm. wide, with acuminate beak, sessile, smooth. Flowers racemose on short pedicels, few, about 1.5 cm. long. Calyx tube short-cylindric, teeth subulate and about

a quarter as long as tube. Bracts small and subulate. Peduncles at least as long as the leaves. Leaves 3-5 cm. long. Leaflets 6-8 pairs, linear-oblong and obtuse, long-petiolulate, 1-1.5 cm. long, ashy when young. Stipules linear-lanceolate, about 4 mm. long. Stems short and flexuous. Zacatecas Mexico. From the description there is little to separate this from *A. Antoninus* or *gracilentus* forms.

157 *Astragalus Antoninus* Watson Proc. Am. Acad. 17 343 (1882). This differs in no particular from *A. coriaceus* except the stipitate pods being slightly sulcate dorsally. The flowers are about 2 cm. long. Banner elliptical, about 7 mm. long, arched abruptly to 45 degrees at end of calyx teeth, about 4 mm. longer than keel and a little longer than wings. Wings and keel as in *A. gracilentus*. Calyx tube short-cylindric, about 5 mm. long, inserted on the lower corner, and the minute teeth triangular and hardly a quarter as long as calyx tube. The rather pubescent pods seem to be ascending or spreading. Saltillo Mexico, probably Socorro Co. New Mexico, Metcalf.

158 *Astragalus pinonis* Jones Cont. 8 14 (1898). Pods straight or slightly arcuate below, short-stipitate, oblanceolate, shortly acute at both ends, 2 cm. long, 4-5 mm. wide and high, corrugated, coriaceous, somewhat inflated, with both sutures narrowed and rounded externally, the ventral suture a little raised, neither suture at all intruded, pods reflexed, with ventral side nearly straight, the dorsal side convex. Flowers apparently purple. Banner oval and about as long as keel. Keel purple tipped, about 5 mm. long, erect tip, straight, acute, produced and nearly 3 mm. high, 2 mm. wide at base, as long as the oblong wings. Calyx campanulate-cylindric, narrowed below, the tube a little over 2 mm. long, the subulate teeth 1 mm. long. Bracts triangular, 1 mm. long. Pedicels slender, reflexed, 4 mm. long. Peduncles 2.5-5 cm. long, shorter than the leaves, racemosely few-flowered, with rachis from half to as long as peduncles. Leaves 5-7 cm. long, short-petioled. Leaflets linear, rounded at both ends, barely petiolulate, 4-10 pairs, 1-1.2 cm. long, 2 mm. wide, not contiguous. Internodes 1.5-2 cm. long. Stipules triangular, small, not over 2 mm. long, distinct, not membranaceous. Stems rather slender, ashy-puberulent throughout, nearly erect, branched below, rounded, about 2 dm. long, wiry, green (as is the whole plant), but pubescence ashy and tangled. It has the habit of *A. atratus* and growing in similar places on gravelly benches at Frisco Utah. Lower Temperate life zone. It is possible that when better known this may belong to the *Louchoearpi*.

159 *Astragalus Neomexicanus* Wootton & Standley Cont. Nat. Herb. 16 136 (1913). Pods thick-walled, round in cross-section, densely pubescent when young (only very immature pods known). Flowers purple, about 2 cm. long, several to many, in racemes which with the peduncles are 15-25 cm. long. Banner and wings longer than the rounded keel. Bracts linear, 4-6 mm. long. Pedicels 2-3 mm. long. Calyx campanulate, gibbous above, 7-9 mm. long, sparsely pubescent with short black and white hairs, with subulate teeth about a third as long as tube. Leaves 10-18 cm. long. Leaflets about 20 pairs, villous with weak and spreading hairs, elliptical to ovate-lanceolate, acute, 10-12 mm. long, smooth above. Stipules triangular-lanceolate, about 1 cm. long, connate. Stems a foot long, ascending, branched from base, perennial. No. 690254 Nat. Herb., from James's Canon Sacramento Mts. New Mexico, 7000 ft. alt., July 20 1899, Wootton. This seems to be *A. gracilentus*, but the poor material makes it doubtful.

160 *Astragalus Sileranus* Jones Cont. 2 242 (1891). Pods in the type almost leathery, but varying to almost papery in some forms, oblong-oval to globose, normally (in the type) rounded at both ends, straight, horizontal, 1.5-2 cm. long, about 1 cm. wide and nearly as high, a little obcompressed, and slightly oblique, with flat and up-turned beak very short, and with dorsal suture a trifle intruded, and pods about round cross-section, except for the shallow groove along the ventral suture, mottled and very finely cross-nerved, evidently inflated, single to few. Flowers cream-colored, yellowish when dry,

sometimes the bases of wings and keel are purple, about 8 mm. long, 10-15 in number, sessile, stubby. Banner about 2 mm. long, abruptly arched at calyx tips to nearly erect, oval, the sides reflexed 45 degrees at a point a little above the base, and fully 2 mm. wide there, but not at all at tip or very base; groove very wide and pear-shaped with the wide end up, 2 mm. wide and 1 mm. deep and with an additional groove in the middle; blade rather hooded, waterlined from the back much as in *A. Beckwithii* the groove filling the whole of the banner tip and narrowing below, U-shaped above and V-shaped below. The wings are oblanate, obtuse, arched so that the base follows the curve of the keel, fully 1 mm. wide, close-pressed to keel, but toward the tip the upper edges spread a little, about 1 mm. longer than keel. Keel about 4 mm. long, the base bent in a rather long arc and then abruptly rounded to a little more than erect, and with a deltoid and obtuse tip which is a trifle darker but not distinctly purple, about 2 mm. shorter than banner. Calyx campanulate, abruptly acute at base but appearing truncate, tube about 2 mm. long, not oblique, inclined to be hyaline, with spreading and unequal tips about as long as tube. Pedicels very stout, about 1 mm. long. Bracts firm, ovate, in flower 2-3 times as long as pedicels. Peduncles slender, about 1 dm. long, and rather longer than the leaves. Leaves hardly 1 dm. long, nearly sessile, wide. Leaflets 7-9 pairs, 1-2 cm. long, oval to oblong, obtuse to notched, shortly truncate at the long-petiolate base, thickish, contiguous. Stipules rigid, green, large, triangular, reflexed, adnate, connate only at base of stems, about 5 mm. long. Stems flexuous, with internodes 5-7 cm. long, several from a stout and woody root, straggling over bushes or lying flat on the ground. Whole plant softly pubescent with spreading hairs, growing on gravelly mesas among bushes or under pines, Middle Temperate life zone, from the head of the Sevier and the Colob to Springdale and the Kaibab on the Colorado, Utah and Arizona, blooming in summer. This was named for that indefatigable collector A. L. Siler who worked in this region.

Astragalus Sileranus* var. *cariacus Jones Cont. 7 642 (1895). Pods 2-4 cm. long, variously acuminate-tipped and often tapering at base, the tip being upturned and the base down, and so the pods are oblique, much inflated in the middle, narrowly elliptical, to oval. Leaflets elliptical-oblong, 1-2 cm. long. Elk head ranch on the upper Virgin river Utah.

18 ARGOPHYLLI.

Pods 1-celled, with dorsal suture not raised within except a little in *A. cibarius* and forms of *Missouriensis* and *desperatus*, round to obcompressed and rarely triquetrous in cross-section, mostly ovate to lanceolate in longitudinal-section, with upcurved tip and ventral suture straight or concave, the dorsal suture very convex, the body being oblique to arcuate, rarely both sutures are nearly equally convex and so the pod is nearly symmetrical, pod sessile or only shortly stipitate, mostly rounded below and splitting the calyx, but conspicuously tapering in *A. iodanthus* and *amphioxys*, often cordate at base, 1-5 cm. long (5-8 mm. in *A. lectulus*), normally 2-2.5 cm. long, a little inflated only in some shaggy-podded forms, and a little so in *A. Zionis*, *desperatus* and *tephrodes*, fleshy when fresh but the walls rarely 4 mm. wide, generally cartilaginous when dry, wrinkled, and inclined to have the sutures (which are denser) raised externally and rather sharp on the edge when dry but not raised when fresh, very weakly attached to the calyx and separating from it readily, rarely sulcate, ascending (reflexed in *A. desperatus*), not opening much at maturity and then at tip and along the ventral suture, triangular-acute at tip, shortly racemose. Flowers 1 cm. long (rarely 5 mm. long in *A. desperatus*) or more, mostly large and pink-purple, rarely white or red. Calyx tube cylindrical, but somewhat laterally flattened, with teeth never over half the tube (rarely longer in *A. desperatus*) and mostly much shorter. Pedicels short, generally much shorter than the rather large bracts. Peduncles mostly not longer than the leaves. Upper leaves the largest, petioled (except in forms of *A. inflexus*). Leaflets never linear nor conspicuously fleshy, flat, always jointed to the rachis. Stipules large (rather small in the *Missouriensis* group), never connate, adnate, ovate to triangular-subulate or wider. Stems caespitose, perennial (*A. amphioxys* and *desperatus* bloom the first year), short, prostrate below, often nearly acaulescent, from a thick and often woody root, with the lower internodes very short and stipules often imbricated. Plants rarely 4 dm. long, mostly silvery-pubescent (nearly smooth in *A. cibarius* and *iodanthus*), of the Lower Temperate life zone, rarely touching the edges of the adjoining zones, blooming in spring and fruiting in May and June.

KEY

- A. Pods never evidently woolly nor shaggy (except in *A. desperatus*, *Zionis*, and *Missouriensis*). Pubescence when present loosely appressed.
- AB. Pods not spongy nor conspicuously cellular when dry (except in *A. Shortianus*) nor with the coats separating.

Pubescence attached by the end.

ABC. Pods oblong to linear-lanceolate, not reflexed arcuate or very oblique, generally variably sulcate dorsally and obcompressed, not less than 2.5 cm. long, smooth to very shortly pubescent when ripe, with walls 2-4 mm. thick when fresh, sometimes .5 mm thick in *A. iodanthus*. Flowers narrow. Calyx appressed-hairy, narrow, cylindrical but rather laterally flattened, truncate to shortly triangular at the oblique base, the teeth less than half as long as the tube. Stems 2-3 dm. long, herbaceous, decumbent from a thick and woody root. Internodes longer than the stipules. plants inclined to be green when well developed, and ashy when young, and then with closely appressed short hairs. This group is somewhat related to the *Sarcocarpi*.

ABCD. Pods very fleshy, with walls about 4 mm. thick, shortly acuminate, cartilaginous when dry, but not greatly wrinkled, arcuate, narrow, 2-4 cm. long, with dorsal suture seemingly a little intruded at times. Flowers 1.25-1.5 cm. long, in heads.

Pods with ventral suture much thickened when dry.

Flowers white. Calyx tube about 7 mm. long. 161 *Webberi*.

Pods with ventral suture raised as a thin edge when dry.

Flowers normally purple. Calyx tube 4-5 mm. long.

162 *cibarius*.

ABC2D. Pods not corrugated though finely cross-ribbed, only slightly fleshy, with pulp hardly 1 mm. thick, coriaceous, smooth, mostly mottled. Flowers about 1 cm. long. Stems slender.

163 *iodanthus*.

AB2C. Pods from a little to evidently fleshy, chartaceous or thin coriaceous when dry, reticulated and cross-ribbed, somewhat inflated, ovate to linear-oblong, 1-2.5 cm. long, very oblique, with sharp, triangular, flat beak. Pubescence of the leaves silvery and appressed, with hairs attached by the base.

Pods shaggy with long and spreading hairs. 164 *desperatus*.

Pods only ashy. 165 *tephrodes*.

AB3C. Plants nearly acaulescent or with stems only a few inches long, prostrate. Flowers mostly large, never small. Pods with conspicuously pulpy walls 1.5 mm. thick when fresh, thick-coriaceous to cartilaginous when dry, variously wrinkled and obcompressed, broadly ovate to narrowly oblong, sharply acute to acuminate, with mostly flat beak when dry. *Argophylli* proper.

AB3CD. Peduncles normally not over 7 cm. long, or less than half as long as the leaves, and so the flowers are clustered among the leaves, occasionally fruiting peduncles are 1.5 dm. long. Stipules imbricated.

Flowers spicate, few. Pubescence silvery and closely appressed. (*A. Parryi* might be sought here).

AB3CDE. Pods not inflated, large, almost smooth.

166 *Shortianus*.

AB3CD2E. Pods variously inflated, ovate, rarely broader or lanceolate, mostly shaggy. Flowers capitate.

167 *argophyllus*

AB3C2D. Pods decidedly fleshy when fresh and mostly cartilaginous when dry, ascending. Flowers spicate. Peduncles over 1 cm. long, erect or nearly so, longer than the leaves except when rarely leaves are greatly produced. Stems short but with imbricated stipules

only when young. Plants blooming early in April and May.

Pods long-hairy.

168 Zionis.

Pods appearing nearly smooth.

169 remulcus.

A23. Pods sessile, not evidently inflated, fleshy and pulpy, opening along the ventral suture. Pubescence attached by the middle or near it and hairs pick-shaped. Plants acaulescent, or nearly so in small tufts, short-lived perennials or winter annuals, some blooming the first year.

A2BC. Pods rounded at base, with loose outer coat separating from the inner wall either by a cellular interspace, or by splitting and peeling off. Neither suture intruded, both raised a little externally and thin. Pods not reflexed.

A2BCD. Pods 1.5-5 cm. long, very oblique but not much arched and with tip variably but not greatly upturned, smooth or nearly so when ripe, triangular-apiculate to conical beaked, with pulp coarsely cellular which on drying leaves the two coats separated by a spongy interspace, but the outer papery coat does not peel up, this makes the dry pods very light and easily blown about in the wind; inner coat thicker or tougher, chartaceous. Flowers about 2.5 cm. long, mostly white or brilliant-pink-purple, capitate, few, blooming very early. Peduncles decumbent at least in fruit. Plants with thick, fleshy, tapering, long, erect tap root.

Pods with outer skin conspicuously reticulated, except var. laccoliticus. Flowers white or whitish. 170 pygmaeus.

Pods with outer skin not reticulated. Flowers dark-pink purple. 171 Musiniensis.

A2BC2D. Pods about 1.5-2 cm. long, very fleshy, straight, narrowly oblong, with cross-section nearly round when fresh, 4-angled and not spongy and with raised sutures when dry, but outer coat drying close to the inner wall and when old splitting along the ventral suture and spreading out flat from tip to tip like a wing but not separating along the dorsal suture, thus giving the pod an elliptical outline. In A. Missouriensis this is not so marked and often the outer wall simply separates with age and flares a little. Flowers not large. Claws of petals not exerted. Whole plant hoary even to the peduncles. Missouriensis.

Pods broadly winged when dry. Flowers whitish. 172 cymboides.

Pods not broadly winged when dry. Flowers purple. 173 Missouriensis.

A2B2C. Pods 1.5-8 cm. long, narrowed at both ends, very acute, arcuate, fleshy but not cellular nor spongy nor walls separating, ventral suture conspicuously raised when dry and the dorsal not at all or very thin. Flowers large, 2-5 cm. long, brilliant-pink-purple when fresh, bluish when dry. Stems and peduncles hoary. 174 amphioxys.

2A. Pods densely woolly or variably shaggy, seldom sulcate ventrally and dorsally except at base, normally round to obcompressed in cross-section, sessile or with stipe not longer than wide, conspicuously inflated only in A. Newberryi and funereus forms, splitting the calyx, coriaceous when dry, only slightly fleshy or, rarely, flesh is thicker and cellular, arcuate at tip or, rarely, triangular-apiculate. Flowers purple, rarely white or red, 1.5-5 cm. long, capitate. Calyx tube cylindrical. Peduncles never much longer than

the leaves, mostly shorter. Plants perennial, with caespitose stems prostrate or at least not erect, and having very short internodes, *A. inflexus* sometimes has longer internodes and ascending stems. Whole plant woolly, shaggy or silvery, with mostly slender hairs always attached by the base.

2AB. Pods shaggy, with hairs about straight when dry, inflated, spreading or reflexed. Pubescence of leaves and peduncles neither woolly nor crisped, appressed. Acaulescent or with rudimentary stems, never growing in large and prostrate mats. Old petioles coarse, stiff, persistent. Peduncles neither longer than the leaves nor absent. **Newberryenses.**

Pods abruptly arcuate at tip, rarely twice as long as wide.

Flowers purple or purple-tipped. 175 *Newberryi*.

Pods acuminate-lanceolate and equally arcuate. Flower-cream-colored, or lead-colored when dry. 176 *Eurekensis*.

2A2B. Pods densely shaggy or white-woolly (so much so as to mostly conceal the surface) not inflated (except in the *A. funereus* group), parallel-veined, not noticeably reflexed, opening only at tip. Leaves and petioles soft and slender, soon decaying (except in *A. coccineus*). Internodes not longer than the stipules (except in forms of *A. inflexus*). Petioles very short and thin. Plants acaulescent only in reduced forms, mostly prostrate and matted with slender but short stems. Pubescence rather spreading, of soft and very fine, white or white-tangled hairs like wool (scarcely so in the *A. funereus* group). Flowers narrow, with cylindrical tube and short teeth. Leaflets 5 to many pairs, mostly contiguous, not thick, flat. **Coccinei.**

2A2B2C. Pubescence very dense and white, the hairs tangled and wavy but relatively short and not distinctly woolly but rather spreading and appearing as if woolly or short-shaggy, under the microscope the hairs are mostly parallel. Flowers large, very narrow, with long claws, brilliant-pink-purple or red, mostly bracteate at base, almost sessile on very stout pedicels. Calyx teeth subulate and about 3 mm. long, shaggy, hooked, broad, the short pubescence shaggy but barely concealing the surface. Calyx a little inflated, the upper side somewhat convex. Leaves rarely 7 cm. long, narrow. Peduncles very stout and shorter than the leaves. Plants of the lower edge of the Lower Temperate life zone, growing on rather bare ridges in poor soil inclined to be alkaline but very well drained, in the Death valley region.

Pods about 3 cm. long. Flowers red even when dry. 177 *coccineus*.

Pods about 5 cm. long. Flowers bluish when dry. 178 *funereus*.

2A2B2C. Pubescence of very fine, slender, kinked, woolly hairs. Claws of petals not inserted. Neither peduncles nor petioles persisting. Pods opening at tip along both sutures.

2A2B2CD. Stipules, bracts and calyx lobes not filiform, nor lax at tip, the stipules and bracts large and the calyx lobes short. Wings longer than keel. Leaflets round to oval-obovate and rounded. 179 *Utahensis*.

2A2B2C2D. Stipules, bracts and calyx lobes mostly tapering into thread-like and lax tips. Pubescence inclined to be silky-woolly and rather long. Leaflets normally acutish at both ends, and rather diamond-shaped. Stems slender though sometimes very short to almost acaules-

lescent. Peduncles nearly always shorter than the leaves.
Plants with conspicuous stems. Flowers red-purple.

180 inflexus.

Plants almost stemless. Flowers mostly white. 181 Purshii.

161 *Astragalus Webberi* Gray Bot. Cal. 1 154 (1876). Pods with both sutures raised externally and the ventral much thickened when dry, narrowly-oblong but a little narrowed at both ends, smooth, 5-7 mm. high, 10-12 mm. wide, generally sulcate to the middle but not at the ends, tips broadly triangular and a little laterally flattened, cross-section reniform to oblately obovate. Flowers white, 1.5 cm. long, spreading. Banner elongated and almost erect, narrow, 8-9 mm. long. Wings narrowly oblong, arched to 45 degrees, rounded, about 4 mm. shorter than banner and as much longer than keel or less. Keel about 4 mm. high, straight the end abruptly erect and forming nearly a right angle, purple. Calyx tube about 7 mm. long, attached in line with the base, the upper side a little arched, the lower side straight, the teeth subulate and nearly half as long as the tube. Bracts as long as to a half longer than the short pedicels, lanceolate to ovate. Peduncles longer than the leaves. Heads rather densely 9-20 flowered. Proper petioles rarely as long as the lowest leaflet. Leaflets 5-10 pairs, narrowly oblong-oblancheolate, with cuneate and long-petiolulate base, not over 2 cm. long, not retuse, variably silvery-pubescent. This occurs sparingly on hillsides in the Sierras near Sierra Valley California in the Middle Temperate life zone. It is probably only a marked form of *A. cibarius*.

162 *Astragalus cibarius* Sheldon Minn, Bot. Stud. 9 149 (1894). *A. iodanthus* Watson in part, as to Utah material. Pods puberulent to almost smooth, rather abruptly narrowed and substipitate at base the stipe from barely longer than wide to 2 mm. long and not jointed to the calyx, pods from nearly straight to arched almost to a half circle, 2.5-4 cm. long, 7-10 mm. wide, 5-8 mm. high, oblong to broadly linear, finely corrugated, not mottled, tip from a little to much flattened, triangular, walls about 3 mm. thick when fresh the inner one woody, cross section from nearly round to almost didymous by being much obcompressed, the normal cross-section is nearly ∞ -shaped but the sutures not touching, and the ventral suture raised externally and not intruded and only slightly thickened, dorsal suture raised externally as a thin line when dry and intruded as high as wide in forms with deltoid cross-section, pods often much sulcate along the middle. The flowers purple, bluish when dry with lighter claws, albino forms rare, 1.5-2 cm. long, almost sessile, with conspicuous lanceolate bracts nearly half as long as calyx. Banner ovate, about 1 cm. long, rather deeply notched, with sides much reflexed below so that the banner seems oblong, arched beyond the calyx tips to nearly and rather sharply erect, white spot deep-purple veined and conspicuous, blade deep-purple below and shading to white above or purple throughout, a little sulcate. Wings from nearly as long as banner to 4-6 mm. shorter but much longer and narrower than keel, nearly linear, very rounded, a trifle narrowed in the middle and a little enlarged above, mostly about straight, but sometimes arched to 30 degrees, variably purple at base, white above, rarely purple throughout, flaring at tip and the ends turned to horizontal, obscurely erose or notched. Keel about 5 mm. long and 4 mm. high, the base straight and then abruptly arched to erect and with tip very obtuse, rounded, and deep-purple. Calyx nigrescent, with tube about 4-5 mm. long and nearly half as high, cleft deeper above, and triangular teeth about one fourth as long. Peduncles normally shorter than the leaves, rarely longer, stout, with the pods shortly racemose. Leaves with petioles mostly twice as long as the lower leaflets. Leaflets about 9-12 pairs, from oval-ovate or obovate to cuneate-oblong, mostly notched, about 1 cm. long, rarely 2 cm. long when over developed, slender-petioled, green above, not

thin, ashy below or on the margins, contiguous. Stipules large, green above, ovate or broader, obtuse, often nearly as large as the adjoining leaflet, veiny, adnate and connate on the petiole side but free or nearly so on the other, in young plants often almost imbricated, nearly smooth. Stems many, 1-2 ft. long, green. Very abundant throughout Utah, except the Navajo basin, in valleys and on dry mesas in the sagebrush, never in alkaline soil, also extending to the headwaters of Green river and the Wind river Mts. Wyo., throughout Idaho to Weiser and eastward and northeastward to the Continental Divide, northward through Montana on both slopes but only on the headwaters of the Columbia drainage particularly the Missoula and Deer Lodge valley, not elsewhere in the Columbia basin, southward to the Virgin river Utah, westward to eastern Nevada where it is replaced by *A. iodanthus* of which it there appears to be a well-marked variety. Lower Temperate life zone, extending up into the Middle Temperate life zone. Blooming in spring and fruiting in June.

153 *Astragalus iodanthus* Watson Bot. King 79 (1871). Pods linear lanceolate, acuminate, mottled, 3-4 cm. long, arcuate almost to a circle, completely obcompressed except at very base and the flat and ensiform tip, broadly sulcate dorsally the suture slightly raised within but a mere line without, the ventral suture a little thickened but little raised, pods about 2 mm. wide, 2-3 mm. high in the middle, cross-section almost linear, base a little narrowed or tapering but notched and on a minute stipe and inclined to be jointed to it. Flowers normally white, rarely light purple. Banner oblong, about 1 cm. long, abruptly erect at calyx tips or nearly so, sides reflexed most just below the middle and thus making banner fiddle-shaped, not reflexed at tip which is about 5 mm. wide and light-purple to white, the white spot obovate and purple veined, the blade thin, the groove U-shaped and 1 mm. thick and rapidly shallowing to a mere line above, the banner deeply notched. Wings oblong, arched from a little to 15 degrees, a trifle larger above and obliquely rounded, bluish purple above when colored, almost flat to keel with the upper side a little concave to it and the lower side the reverse, with flaring tips 2 mm. apart, about as long as banner, 3 mm. longer than keel, about 2 mm. wide, not horizontal. Keel with straight base and abruptly erect tip, rounded, obtuse, purple. Calyx tube about 5 mm. long, 1 mm. wide, 2 mm. high, campanulate-cylindrical, not cleit deeper above, teeth triangular-subulate, fully half as long as tube which is thin and hyaline and but slightly nigrescent with minute hairs. Pedicels short. Bracts much longer than pedicels, subulate-lanceolate. Flowers in loose heads. Peduncles rather stout, and rarely as long as the leaves. The leaves 5-7 cm. long, with petioles of lower ones much longer than the leaflets, those of the upper leaves shorter than the leaflets. Leaflets about 10 pairs, nearly oval-obovate, about 1 cm. long, green on both sides, sometimes ciliate, obtuse to notched. Stipules triangular, not conspicuous, 2-4 mm. long, only the lower ones somewhat enlarged, thin, hyaline, reflexed. Stems many, flexuous, often nearly prostrate, 1-2 ft. long, from rather slender woody roots. In flower some forms cannot be distinguished from *A. lentiginosus*. Common in the sagebrush along the eastern slope of the Sierras about Reno Nevada and extending eastward to Unionville and probably to Palisade though the latter forms have stipules more like the preceding species, and pods a little thicker but otherwise similar. It is probable that the more alkali and less humidity of western Nevada accounts for the differences of these two species. Lower Temperate life zone. The valves of the pods often curl out like rams horns, hence arose my name "arietinus" Watson's name is usually inappropriate.

164 *Astragalus desperatus* Jones Cont. 2 243 (1891). Pods from broadly ovate to linear-oblong, shaggy with long and spreading hairs but not so as to conceal the surface, sometimes smooth when old and by shedding the pubescence, very variable, 1-2.5 cm. long, 3-4 mm. high, 4-7 mm. wide, from triquetrous in cross-section or cordate to

obcompressed and sulcate at both sutures so that the cross-section is nearly linear, mostly bisulcate to very base along the ventral suture toward the base but not at all at the triquetrous tip which is ensiform and arcuate or strongly incurved, pods from nearly straight to arched into nearly a half circle, a little narrowed below in the narrow forms and notched at the ends at the very weak attachment, almost sessile, from nearly coriaceous to almost papery (the walls a little fleshy and woody when fresh) and finely cross-lined or varying to strongly ribbed, green or mottled, filled with pulp, closely reflexed, with ventral suture raised and thick, and the dorsal suture a mere line externally and double with age and thickened within and raised as a mere line. Flowers about 1.5 cm. long, straight, mostly narrow, few to many, brilliant-pink-purple at tips when fresh. Banner ovate, about 7 mm. long, abruptly arched at end of calyx tube to 45-80 degrees, with sides reflexed to the midrib 2 mm. wide below and so appearing fiddle-shaped, white or cream-colored, with white spot obcordate and purple-veined and coming within 2 mm. of tip, with the groove about V-shaped to semicircular and nearly 4 mm. wide at tip. Wings linear, very oblique, arched to 30-45 degrees, about 2 mm. wide, acutish, a little longer than keel, purple above. Keel about 2 mm. shorter than banner, arched from base to the erect tip, about 3 mm. wide throughout, the tip obtuse but not rounded, deltoid, dark-purple. Calyx cylindrical, about 7 mm long or less, straight, attached on the lower corner but with straight sides, about 3 mm. high, reddish, with fine, white, crinkled, short hairs closely appressed: tube fleshy at the insertion, not cleft deeper above, the triangular teeth about a third to fully as long as the tube and capillary. Bracts broadly ovate and hyaline, about 2-3 mm. long, rigid and as long as the pedicels. Peduncles subscapose, stout, 5-7 cm. long. Leaves not over 3 cm. long, with slender petioles twice as long as the leaf-rachis. Leaflets 4-6 pairs, elliptical to obovate, obtuse, not over 1 cm. long, rather thick, folded and variably silvery on both sides with loosely appressed hairs. Stipules large, imbricated, shaggy, round to oval, rarely ovate, hyaline, 4-5 mm. long, very conspicuous, acute. Stems very short and with congested internodes, only a few inches long at most, rigid, inclined to be woody, prostrate or spreading, many and caespitose from the crown of the erect and woody root, growing in rocky places, preferably crevices, often along with *A. pubentissimus* which at times is very similar but without the large stipules and congested internodes. It sometimes blooms as a winter annual. Common throughout the San Rafael Swell, and growing from Green River to Grand Junction and southward to the Moencoppa Arizona where it grows with *A. sabulorum* and is distinguished from it by the caespitose habit and stipules. Lower Temperate life zone.

***Astragalus desperatus* var. *petrophilus* n. var.** Pods rigid, decidedly inflated, rarely 1 cm. long, half-oval to obliquely obovate, 4-5 mm. high, with ovate to cordate cross-section, generally a little sulcate dorsally near the base, and sometimes also ventrally there but the ventral suture mustly a straight, thick and raised line, and the dorsal suture a raised and thin partial partition within, tip of pod very sharp, upturned, deltoid, with a sharp and subulate beak, surface of pods so shaggy as to conceal the skin, sometimes cross-ribbed, the pubescence falls off long after maturity, pods indifferently spreading, 1-3 on the ends of the filiform peduncles which are 1-10 cm. long, and rarely as long as the leaves. Flowers 5-7 mm. long, from stubby to narrow, 1-5 on the ends of the peduncles, not reflexed. Calyx teeth from rudimentary to triangular and 1 mm. long. Leaves very much reduced and short. Leaflets 2-3 pairs, thickish, ashy, 3-4 mm. long, elliptical, folded, obtuse. Petioles about as long as the leaf-rachis. Stems form an oblong mass of imbricated stipules, rarely 1 cm. long, many on the crown of the erect root, the mat 4-6 inches wide. Very variable. This is the most condensed form and the smallest mats re-

semble, closely, *A. montanus* and *A. humillimus*. It grows in crevices of flat rocks, in the San Rafael Swell region Utah, and blooms in May and June, and fruits soon after (as does the species).

165 *Astragalus tephrodes* Gray Pl. Wr. 2 45 (1853). Pods about half-oval-ovate, nearly half as high or wide as long, about 1 cm. long, ashy, normally ascending in short spikes, a little arcuate toward tip, sessile at the rounded base, weakly attached, rather finely cross ribbed and inclined to be sulcate below at both sutures and obcompressed at very base, cross-section obcordate to slightly didymous, both sutures thickened externally. In the type, which is based on two small specimens in fruit only, the pod is half-moon shaped, with straight ventral suture, sulcate dorsally and with flat and deltoid tip, hoary with minute hairs. Other material from Socorro has pods from obliquely ovate to arcuate-lance oblong, with triangular and flat tip about twice as long as wide and inclined to be sulcate at both sutures but with similar beak. Walls very fleshy when fresh but thin when dry. My own specimens from the Needles Cal. have pods more acute. The flowers in the type are described as about 1 cm. long and purple. In the Socorro material and my own the flowers are 1-1.5 cm. long and purple tipped, like *A. remulus* but shorter and smaller. They have the same short-cylindric calyx tube appearing campanulate in fruit with teeth triangular and nearly half as long as tube. The calyx can hardly be called woolly though the appressed hairs are somewhat tangled. Peduncles about 1 dm. long, having the rather many flowers spicate. The bracts and pedicels are the same as in *remulus*. Leaflets 7-10 pairs, elliptical to oval, obtusish, contiguous or separated, about 1 cm. long, loosely silky with somewhat tangled long hairs. Leaves about 1 dm. long, with petioles shorter than the rachis. Stems slender and decumbent or prostrate and with few nodes, as in *remulus*, arising from slender underground root branches. It was described as a possible biennial. From the western base of the Organ Mts. New Mexico to the Needles Cal. Tropical, on benches. It seems to be rare. This species has some resemblance to *A. Feensis*.

166 *Astragalus Shortianus* Nutt. in T. & G. Fl. N. A. 1 331 (1838). *A. humilis* Geyer. Pods from lanceolate to linear-oblong (even ovate in the variety), corrugated, cellular when dry, rounded at base, jointed to the calyx, inclined to be sulcate at both sutures below, acuminate, 2-7 cm. long, 10-15 mm. wide, rarely over 5 mm. high, somewhat arcuate especially toward the mostly flat and ensiform triangular tip, broadly sulcate dorsally and mostly bisulcate ventrally, much obcompressed when mature, often round in cross-section when fresh, minutely pubescent, not mottled, ascending, with ventral suture thickened and raised externally, and the dorsal suture not intruded, outer coat showing little tendency to separate from the inner, walls 4-5 mm. thick when fresh, the inner cartilaginous when dry. Flowers about 2-2.5 cm. long, crowded at end of peduncle, brilliant purple, with long claws. Banner about oval, 1 cm. long, arched to 45 degrees in gentle arc from end of calyx tube, rarely erect, with sides much reflexed in age below, about 2-4 mm. longer than wings. Wings obliquely linear-cuneate, rounded, about 2 mm. wide, much narrower than keel, 2-3 mm. shorter than keel, arched little, with tips inclined to be horizontal as in *A. Utahensis*. Keel straight to near the tip and then abruptly rounded to erect at the obtusely triangular tip which is about 4 mm. high. Calyx tube cylindrical, 7-8 mm. long and 3 mm. high, nigrescent with rather shaggy hairs, straight, not deeper cleft above, teeth subulate and nearly half as long as tube. Bracts subulate, nearly 1 cm. long. Pedicels slender, 3-5 mm. long. Peduncles in flower rarely 2 dm. long but somewhat longer in fruit, subscapiform, sulcate, stout, 3-12 flowered. Leaves often 1.5 dm. long, the petiole half the whole. Leaflets 7-14 pairs, 7-23 mm. long, from nearly oval to broadly elliptical, inclined to have cuneate base and be long-petiolulate, flat, rounded and obtuse, nearly contiguous, variably pubescent with hairs normally very fine and long and inclined to be tangled on the calyx and looser, but hairs rarely short and broader. Internodes rarely as long as the

normally much shorter or absent and plants then acaulescent. Stipules large, triangular to subulate-lanceolate. Crown branches many, forming a dense tuft. Common on the plains and foothills of the Rockies from central Wyoming and the Laramie plains southward through the mountains at low elevations, westward to Sapinero Col. and Santa Fee New Mexico and the Plains to the eastward, not in Arizona. Middle Temperate life zone in gravelly soil.

Astragalus Shortianus Var. cyaneus (Gray) Jones Cont. 85 (1898) and 1065 (1902). *A. cyaneus* Gray Pl. Fend. 34 (1849). This differs from the type in the ovate pods being about 2.5 cm. long, the shorter and wider pubescence not at all shaggy on the calyx, smaller leaves and more condensed habit. Leaflets rarely over 1 cm. long, oval and with cuneate base. Bracts about 4 mm. long. Pedicels about 1 mm. long. Flowers about 1.5 cm. long and short-clawed. Calyx tube about 3 cm. long, the short teeth 2 mm. long. The hairs often have a little knob near the base showing a tendency to be fixed above the end as in the next group. This is the common form of the Rio Grande to Texas. *A. Shortianus* var. *minor* Gray, in so far as it differs from this is a form of *A. Missouriensis* which intruded sutures and pick-shaped hairs.

167 **Astragalus argophyllus** Nutt. in T. & G. Fl. N. A. 1 331 (1838) *A. glareosus* of most authors, not Douglas. Pods very variable, always pubescent with rather loose and not appressed hairs, never really shaggy, fleshy, with pulp about 2 mm. thick and a hard inner woody wall (pulp thinner in southern regions), somewhat wrinkled when dry but with smooth outline when fresh, from nearly round but obliquely beaked to oval-ovate and oblong-ovate when large, 5-7 mm. high, about 1 cm. wide and 1.5 cm. long, rarely more, sharply shortly arcuate toward the tip, jointed to the calyx and with a minute stipe when dry and rounded to notched at base, a little sulcate ventrally, flattish dorsally and rarely sulcate except at very base where it is inclined to be sulcate at both sutures and obcompressed, but with sutures not intruded, from very little inflated in the type to much inflated in the var. *cartagineiformis*, cavity full of hairs, cross-section about oval, sometimes rather didymous when sulcate, vertical longitudinal section oblong-arcuate. Flowers 1.5-2.5 cm. long, brilliant pink-purple, often deep blue when dry (due to the all alkali in drying papers), narrow, in heads at the ends of slender peduncles, which never exceed the leaves and mostly are very much shorter. Claws of petals exerted except when old. Banner about 1 cm. long, oblong-oval, dark-pink-purple around the edges, strongly nerved, with sides reflexed widely to 45° from calyx tips, with white spot large and coming within 2 mm. of the edge and narrowed below and with ragged edges and red purple and branching veins. Wings narrowly oblong, 1-3 mm. shorter than the banner and as much longer than the keel, a little arched and narrowed above, 1-2 mm. wide and much narrower than keel, purple-tipped and horizontal at the ends and obliquely rounded. Keel 5-6 mm. long, with the base straight and gently to abruptly arched to erect, the rounded and very obtuse tip somewhat protracted and 3 mm. high and 1 mm. wide at the end, purple but white below as are the other petals. Calyx very thin and hyaline, narrow, about 1 cm. long, exclusive of the subulate teeth which are from a third to a fifth as long as the tube 2-3 mm. high, 1-2 mm. wide, rather fleshy at base, cleft deeper above and with teeth unequal. Bracts ovate to narrowly lanceolate and conspicuous, about 5 mm. long and at least twice as long as the rather stout and variable pedicels, shaggy but mostly hyaline. Peduncles from almost none to half as long as the leaves, or rarely nearly as long as the leaves, generally spreading on the ground, but sometimes ascending at the tip, the floral rachis rarely 2-4 cm. long in fruit and with few pods. Leaves narrow, rarely 1 dm. long, slender, the petiole proper about half the leaf rachis. Leaflets about 8 pairs, not contiguous, from lanceolate and very acute to obovate and apiculate, but

normally acute at both ends and appearing diamond-shaped, short-petiolate, 5-12 mm. long, broader when short, densely silvery-silky with fine and soft hairs which are rather loose and inclined to be wavy. The type has rather long peduncles and acute leaflets but is without mature fruit, but there can be no mistake about its identity. It has been uniformly referred to *A. glareosus* which is a form of *A. inflexus* with short stems and belongs to the Columbia drainage. The stems are woody but slender, spreading flat on the ground and hugging it closely as if rooting, with short internodes, mostly only a few inches long (rarely a foot long), caespitose. Stipules rather small below but often 1.5 cm. long above, triangular to oblong-lanceolate, hyaline and veined with green, nearly smooth. Rather common from Monida Montana and central Wyoming and the Laramie plains southward to New Mexico on the Pacific slope, and westward to the Mogollons of Arizona, and northwestward to the base of the Sierras at least as far as Reno Nevada, and throughout the Great Basin, and on the Snake river toward its head in southern Idaho. It grows in mountain valleys in moist meadows on gravelly knolls in sweet soil, Middle Temperate life zone, not in the Columbia Basin except on the upper Snake river. Nuttall's type is a long-peduncled form from Wyoming, with narrow and acute leaflets, in flower, and with immature pods and with the characteristic silky pubescence closely appressed. The species has very variable pubescence but it is always silky even when short and appressed, but it is rarely as closely appressed as in those species with pick-shaped hairs, and is finer than in most forms of *A. Shortianus*, and is without the peculiar woolliness of the *A. inflexus* group, the flowers also are paler and without the deep-red of *inflexus* which makes them appear bluer in dried specimens even when they are as deeply colored (doubtless because there is more acid in the flowers and becomes bluer in contact with alkaline driers), but mostly they are purple-tipped only, while in *inflexus* the flowers are more or less tinged with red even when dry (showing a different chemical nature more like *A. coccineus*), the pods of *inflexus* even when nearly smooth have long and woolly hairs.

A. argophyllus blooms from May to September. There has been much confusion about it, Nuttall mixing it with *A. Purshii*, Torrey and Gray with *A. glareosus*.

This species appears to hybridize with *A. Purshii* very rarely, the *tinctus* variety forming ***Astragalus argophyllus* x *Purshii***, when the pods are somewhat narrower, sparsely short-shaggy, with oval and normally obtuse small leaflets of the *tinctus* variety. Such forms are 5412d Jones from Salina Canon Utah, 6054h Jones from Nagle's ranch on the Kaibab Arizona, and other material from Miller canon in the Navajo Basin south of Price Utah.

Astragalus argophyllus* Var. *Pauguicensis Jones Cont. 7 671 (1895) and 8 5 (1898). This has densely silvery leaves with oval and obtuse small leaflets, and with linear-lanceolate pods about 2.5 cm. long and 5-7 mm. wide, shortly acuminate, very much obcompressed, doubly sulcate ventrally and not at all dorsally, finely and closely appressed-pubescent. In meadows at Pauguitch Lake Utah. A form with similar pods 4 cm. long and with narrow leaflets like those of the variety *Cnicensis* is from Thistle Utah.

***Astragalus argophyllus* Var. *Martini* N. Var.** This is a very condensed form without peduncle or very short if any, with imbricated stipules, with elliptical to diamond-shaped and silvery-silky leaflets, the largest not 1 cm. long, and with claw-like pods hardly 1 cm. long and deeply corrugated, with both sutures narrow and a little raised externally, not sulcate at either suture but a little obcompressed, ovate, the flat tip sharply arcuate to erect, sparsely short-hairy. Soda Springs Idaho June 19 1901 Rev. Geo. W. Martin. A form with longer peduncle I collected at Park City Utah.

Astragalus argophyllus var. cnicensis N. Var. This is a form with long peduncies, stipules nearly contiguous, with stems many and densely tufted, short, ascending and with very many greenish leaves with very short and sparser pubescence, with narrowly elliptical apiculate leaflets about 1 cm. long, and with claw-like pods nearly 2 cm, long and not corrugated but ashy with short and rather dense hairs, lanceolate, a little sulcate at both sutures, with the flat tip abruptly arcuate to erect, decidedly obcompressed. Thistle Utah 1901, Mammoth Utah 1911, in fruit in May and June.

Astragalus argophyllus var. castanaeformis (Watson Proc. Am. Acad. 20 361 1885 as species) Jones Cont. 10 62 (1902). Pods coriaceous, little wrinkled, the walls when dry in some forms are almost chartaceous, conspicuously inflated, broadly ovate-triangular, half-oval, about 1.5 cm. long, 1 cm. wide, 5-7 mm. high, ashy, with ventral suture raised and thickened and straight and ending in the flat very short and deltoid beak, cross-section ovate-triangular, rarely slightly sulcate broadly near the base, dorsal suture very convex and raised as a thin line but not intruded. Peduncles 2-3 cm. long. Flowers about 10, light-colored, the tips of wings and keel purple. Leaves 4-8 cm. long, with the petiole often as long as the rachis, Leaflets 4-8 pairs, obovate to elliptical, acutish to rounded, rarely 1 cm. long, ashy with short pubescence. Stems densely congested and very short, with imbricated stipules. This is the thinnest-walled form of the species, it grows in the pine forests of the Mogollons about Flagstaff and Williams Arizona.

Astragalus argophyllus var. pephragmenus (Jones Cont. 5 267 1893 as species). Pods about 2.5 cm. long, 7-10 mm. wide, about 5 mm. high, very fleshy, a little wrinkled, cartilaginous, from nearly lanceolate to oblong-ovate, oblique to a little arcuate, ashy, rounded and jointed to a very thick and short stipe, scarcely more than strong- and deltoidly flat-beaked, with ventral suture very thick and raised (about 1 mm. thick when dry), mostly straight, with dorsal suture a mere raised line externally and internally, convex, pods flattish dorsally and sometimes a little bisulcate ventrally, cross-section about oval when dry, inflated. Leaflets 5-15 pairs, about oval, apiculate, rather thick, rarely 7 mm. long, densely silvery-hairy, with closely appressed hairs. Petioles often longer than the leaf rachis, and the leaf about 5-8 cm. long. Stems much branched and tufted, ascending, a few inches long, with internodes, longer than the stipules, and the peduncle a little longer than the leaves. Top of the Pinal Mts. Arizona among rocks, Middle Temperate life zone. This at once suggests *A. Shortianus* var. *cyaneus* but the pubescence is that of *argophyllus* with the wavy and fine hairs fixed strictly by the base, and the stems with produced internodes, but the pods are more like that variety

Astragalus Zionis Jones Cont. 7 652 (1895). Pods arcuate, horizontal, abruptly long-acute with flat and subulate style, linear-oblong, 2.5-3 cm. long, about 7 mm. wide and high, rather triangular but with rounded sides, flattened to a little sulcate dorsally and somewhat obcompressed, but round when fresh, with cross-section oblong externally and linear internally, with walls 2 mm. thick when fresh the inner part only coriaceous and wrinkled when dry, mottled, dried immature pods are laterally flattened, ventral suture not raised when fresh, when dry the suture is conspicuously raised and with the sides rather flat and at a sharp angle to each other, jointed to the calyx, rounded and rather narrowed to it, shortly sparsely shaggy with rather spreading hairs, never sulcate at base, widely spreading, when much arched then much obcompressed, the thread-like beak often 1 cm. long. Flowers short-racemose on stout and nearly erect peduncles 1-2 dm. long, purple-tipped, 14-20, about 2 cm. long. Banner a little over 1 cm. long, oval-ovate, with sides reflexed 2 mm. wide in the middle only, arched to 45 degrees beyond the calyx teeth, and groove nearly forming two thirds of a circle being 3 mm. wide

and 2 mm. deep, very broad and large, and shallowing toward the tip, white spot M-shaped, large, purple-veined below and stippled above. Wings linear, 2 mm. wide, somewhat ascending, rather obtuse, tips horizontal and connivent, purple throughout, 2 mm. longer than keel, and 2 mm longer than banner. Keel straight, bent sharply to erect at the end, purple, triangular-acute, and 3 mm. high, about 7 mm. long. Calyx obliquely cylindrical, the tube about 7 mm long, a little narrow at tip and base and deeper cleft above, about 3 mm high, laterally flattened, light-colored or reddish, attached in line with the fleshy base and with the upper side arched a little and also with the lower side straight, loosely short-nigrescent with the wavy hairs little spreading, nearly sessile on very stout pedicels. Calyx teeth rather thread-like and about one third as long as the tube. Bracts subulate, with filiform tips, nearly 1 cm. long, green. Leaves, 1-3 dm. long, very narrow, the petiole nearly half the whole, and the rachis conspicuously tapering to a fine point and rigid though slender. Leaflets from ovate and very acute to diamond-shaped, 5-20 mm. long, distant, about 5-8 pairs, long-petiolulate, ashy with minute and very fine and appressed short hairs. Stipules triangular-subulate, 1-1.5 cm. long, green and veined, adnate but not at all comate. Stems hoary, rarely 1 dm. long, with 5-8 internodes, ascending from a woody base, much branched, some of the nodes 2-3 cm. apart. This grows in red sand on gravelly slopes near rocks or hanging in festoons from the rocks along the Virgin river from Belleview to Little Zion Utah. Lower Temperate life zone. The species reminds one of *A. Parryi* but the pods are those of the amphioxys group, and the pubescence that of *argophyllus* though looser and may be an extreme form of it, but the habit is that of *spendiflorus* and *Parryi*. The peculiar fleshiness of the fresh pods does not show in the dried fruit.

169 *Astragalus remulcus* Jones Cont. 7 658 (1895). *A. amphioxys* var. *brachylobus* Gray, not *A. brachylobus* DC. Pods 2-4 cm. long, 7-10 mm. wide or high according to the compression, very thick and cartilaginous when dry, the walls thick and woolly, and the fleshy pulp thick when fresh, decidedly oblique but not much acuminate, from obliquely ovate to narrowly oblong and very variable in shape, longitudinally wrinkled and somewhat corrugated vertically, appearing nearly smooth but minutely woolly, rounded at base and sessile in the calyx, rather blunt at the oblique tip where the thickened sutures are united into a very thick flat prow much wider than long which is abruptly produced into a nearly round and very stout beak 1-2 mm. long which ends in a filamentary recurved style 5-10 mm. long, slightly inflated, ascending and rather appressed-spicate, ventral suture very thick (about 1 mm.) and a little raised, dorsal suture somewhat thickened and raised but not intruded in the type. Pods normally obcompressed a little below the middle, with oval cross-section, but sometimes laterally flattened a little and with cross-section vertically oval, apparently never sulcate, often appearing 4-angled by the contraction of the walls at the sutures. Flowers 10-20, loosely short-spicate, almost sessile, spreading, light-colored and purple-tipped, not narrow, 1-1.5 cm. long, rather stubby. Banner about as long as calyx tube, 7-10 mm. long, oval, arcuate remote from the tip of calyx tube in a gentle arc to 45-90 degrees, whitish or purple-tinged around the edges, with sides reflexed a little along the middle. Wings narrowly-oblong and rounded, arched a little, about 2 mm. wide, a little longer than keel and 2 mm shorter than banner, purple. Keel straight, about 5 mm. long, the end abruptly erect and 3 mm. high and with rounded apex. Calyx tube broad, 6-7 mm. long and 4 mm. high, flattened laterally a little, short-cylindric, attached in line with the fleshy base, the upper side slightly convex and cleft deeper above, short-woolly, the deltoid teeth about 1-3 mm. long. Bracts ovate to oblong, hyaline long-ciliate, 3-5 mm. long and longer than the stout pedicels. Peduncles stout, about as long as the leaves or more, and with the floral rachis, exceeding them, arcuate, 1-1.5 dm. long. Leaves rarely 1 dm.

long, flexuous, the stout petiole decidedly shorter than the rather tapering rachis. Leaflets thick, 10-17 pairs, oval, 5-30 mm. long, often acutish at both ends, strongly petiolulate, often nearly contiguous, inclined to be smooth above and short-wavy-hairy below and on the margins. Stipules triangular, green above, about as long as the nearest leaflet, adnate, not connate. Stems very short, woody, and almost creeping as in *A. argophyllus*, the season's growth with white internodes nearly 3 cm. long. Western side of the Mogollon plateau from Prescott and Skull valley Ariz. to Springdale Utah, and eastward at least as far as Flagstaff Ariz. Lower and extending into the Middle Temperate life zone, among pines and junipers on mesas. This is a well marked but very variable species with pods much like those of *A. Missouriensis* but thicker, the pubescence and habit and general characteristics are those of the *argophyllus* group. It has been referred to both *Missouriensis* and *Shortianus*, and may be a form of *argophyllus* var *pephragmenus* but the broad and stubby flowers with petals all about equal are different.

***Astragalus remulcus* var. *Chloridæ* N. Var.** Pods linear-oblong, about 3-4 cm. long, 5-9 mm. wide or high, often arched to a half circle. Dorsal suture infolded (but pods scarcely sulcate) and then produced as a thin partition over half way to the ventral suture, or pods wholly 1-celled and suture not intruded. Pods and flowers racemose, with the rachis 1-2 dm. long, on peduncles 1-2 ft. long. Calyx teeth subulate, 1-3 mm. long, nigrescent. Leaflets elliptical and nearly always strongly apiculate. Proper stems almost none. This is a striking variety, appearing as if a hybrid with *A. Layneae*, but with only the septum of that species. Chloride Ariz., among junipers on gravelly mesas. It blooms in April.

170 ***Astragalus pygmaeus* Nutt.** in T & G. Fl. N. A. 1 349 1838 as Phaca). *A. Chamaeleuce* Gray Bot. Ives 10 (1860). The *pygmaeus* of authors is a synonym of earlier species. The plant on which Gray intended to found *Chamaeleuce* was *A. Newberryi*, but as he gave no description and cited this as his type *A. Chamaeleuce* becomes a synonym. Pods 2.5-4 cm. long, 2 cm. wide, nearly 1 cm. high, mottled but ashy till mature, elliptical to oblong-ovate, when fresh half-oval-ovate or half-oval and without any apparent sutures and with smooth outline and with pulp about 4 mm. wide when fresh and with large cells which soon dry out and leave air spaces in the pulp, when dry the pulp is about 2 mm. wide and is traversed by threads from the cell walls and by a coarse and fibrous network near the outer skin (shown by interrupted black lines in drawing "a" and flat-wise by "d") which either adheres to the papery skin like the veins in the wing of a cicada (hence my name "cicadae") or separates from it according to the dryness or moisture in the air at the time of maturity. This inner skin is thin but denser and full of fine parallel lines. The cavity of the pod is full of juice which dries to cobwebby hairs. The pods are oblique but a little arcuate if at all. Cross-section round to oblate-oval. The flowers are mostly white or light-colored, about 2 cm. long. Banner oval, about 2 cm long, gently arcuate remote from the calyx to 45-90 degrees, the erect part much shorter than the rest, whitish but purple veined at tip, with sides reflexed about 1 mm. wide in the middle, 2-3 mm. longer than the keel. Wings linear, about 1 mm. wide, a little arched, purple and purple-veined, rounded, hardly 1 mm. longer than keel and much narrower. Keel about 7 mm. long, with straight base, and the tip arcuate in a quarter circle to nearly erect and triangular but obtuse, about 3 mm. high. Calyx tube 6-8 mm. long and 2-3 mm. high, reddish, ashy, deeper cleft above, narrowed below and attached in line with the base, the sides about straight, split by pod at maturity, on a stout pedicel about 1 mm. long which is nearly as long as the thick and green and ovate bract. Calyx teeth triangular and about 1 mm. long in the type. Peduncles stout, longer than the leaves. Leaves 2-5 cm. long in the type, wide, the petiole longer than the short leaf-rachis which is stout and tapers but little. Leaflets contiguous, from

nearly round to oval-obovate, the largest 1 cm. long, thick and flat, very obtuse and rounded and short-petiolulate, in the type about 3-5 pairs. Stems almost none, rarely 2-5 cm. long, densely congested. Stipules ovate to triangular, mostly overlapping, nearly 1 cm. long, shaggy. Whole plant hoary with fine and scarcely flattened and nearly smooth hairs. Pods and flowers ascending, but pods flat on the ground because of declined peduncles. Bad lands from Yellowstone Park to the Uinta Mts. in very poor clay soil, on gentle slopes, upper part of the Lower Temperate life zone. The var. *cicadae* (A. *cicadae* Jones Cont. 4 35 (1893)) is a better developed plant with leaves and peduncles nearly 1 dm. long, leaflets 5-7 pairs, flowers white or brilliant-pink-purple with banner and wings a little longer, the banner often 1.5 cm. long, and calyx teeth 1-4 mm. long. This abounds from Theodore (Duchesne) on the upper waters of the Duchesne river along south of the Uintas to the White river Colorado, in similar soil. All sorts of intergrades occur so that it seems hardly more than a form of the species, the calyx is often black. In its immature state with purple flowers it is not easily separable from *A. amphioxys* except by the broader leaves and shorter flowers, the lowest leaf is often represented by a single large terminal leaflet.

Astragalus pygmaeus* var. *laccoliticus (Jones Cont. 7 672 1895 as *A. Chamaeleuce* var. *laccoliticus*). This differs from the type in the obovate leaflets being deltoid-acute, flowers purple, and in the ovate pods strongly arcuate-tipped having the smooth outer skin of *A. musiniensis*. It appears like a hybrid with *A. Musiniensis* but *A. pygmaeus* is not known in the Henry Mts. Cottrell's ranch Henry Mts. Jones No. 5658q.

171 ***Astragalus Musiniensis*** Jones Cont 7 671 (1895). Pods oval-ovate to lanceolate-ovate, 2-3.5 cm. long, about 1.5 cm. wide and 1 cm. high, slightly arcuate to abruptly and vertically hooked with flattened and deltoid to triangular tip which is not produced into a beak, round and sessile at base, narrowly sulcate ventrally by the suture being depressed, sometimes a little sulcate dorsally, puberulent till mature with short and spreading hairs, smooth and shining when old, not reticulated, single to few, cross-section oval to didymous, longitudinal section oblong to oval at right angles to a line connecting the two sutures, cellular pith between the walls thick and conspicuous (about 4 mm. thick when dry), inner wall smooth and satiny shining, pods wholly 1-celled, with sutures not evident nor raised externally, lying flat on the ground, very light when dry and blowing far away in the wind. Flowers rarely 5, on stout pedicels shorter than the ovate but subulate pointed rather smooth and hyaline bracts, dark-pink-purple, about 2 cm. long, just like those of *A. amphioxys* even to the horizontal and concave wings which touch at the tips. Banner oval-ovate, about 1-1.3 cm long, arcuate at the end of calyx teeth to about 45 degrees, with sides reflexed in the middle for about 2 mms. width, white spot conspicuous, purple-lined and stippled. Wings narrow, rather abruptly contracted above the middle, about 1 mm. wide, rounded, about 2 mm. longer than keel and 4 mm. shorter than banner, a little arched. Keel about 7-8 mm. long, gently arched from below the middle to erect or nearly so at tip, the tip much rounded and 3-4 mm. high, with general outline nearly obliquely oblanceolate. Calyx about 1 cm. long and 3-4 mm high, a little laterally flattened, about straight on both sides, truncate at base and tip and inserted on the corner, nigrescent with minute black hairs, teeth triangular and hardly 1 mm. long. Peduncles scapose, about as long as petioles, normally declined and hooked at the erect tip. Leaves many and congested, 5-7 cm. long, the crowns a mass of old and coarse and stiff petioles (as in *A. Newberryi*). Petioles with a single ovate to triangular leaflet, or 3 digitate ones, or rarely with an additional pair a little below. leaflets normally lanceolate and short-acuminate and sessile, 1.5-2.5 cm. long, hoary with closely appressed hairs attached almost at the end and cross-ribbed. Crowns single to few, 1-5 cm. wide, Stipules

oblong-ovate, not acuminate, nearly smooth, rarely visible. On barren clay slopes from Price to Ferron Utah and vicinity, Lower Temperate life zone.

A common form with shaggy young and sparsely shaggy old pods and 3-5 leaflets from Thompson's Spring and the San Rafael Swell in Utah is the var. *Newberryoides*. The true *A. Newberryi* does not occur in this region.

This species though quite distinct simulates *A. Newberryi* in many respects. The flowers are the same, the leaf habit the same though the latter runs into rather many leaflets in the variety, the condensed crowns the same. The leaflets of *A. Newberryi* though normally nearly round are often inclined to be tapering at tip. The pods are very different when mature. *A. Newberryi* belongs to the Great Basin region though crossing the Colorado drainage at the south, while *A. Musiniensis* grows only on the northern part of the Navajo Basin. It has the appearance of a hybrid between *A. pygmaeus* and some other species, but there is no such other species. Its only associate is *A. cymboides*. It is common and holds its characters. The tap root is many feet long.

172 *Astragalus cymboides* Jones Cont. 7 650 (1895). Pods light-colored, acute at both ends, about 8 mm. wide and high, sharp-edged at both sutures, and with sides rounded, the pulp nearly 2 mm. thick and quickly shriveling when picked, the coat becoming horizontally lined along the middle and with fine but rather indistinct cross lines and unevenly pitted, ashy, with tip flat and triangular-acute and straight, cross-section when dry oblong by the inner walls being much obcompressed, not sulcate, pods when old appearing nearly 1.5 cm. wide and bordered by a line (the edge of the suture), hardly 3 mm. thick in the middle and keeled below (the keel the dorsal suture), trisulcate above by sharp grooves with the central one at the ventral suture and the lateral pair of grooves where the outer wall (now become a wing) joins the body, the space between the central and the lateral grooves is very convex so that the cross-section is about like the figure "3" but with the upper arc the same as the lower. Seeds many and filling the hairy cavity which splits along the ventral suture but does not open except a little at the end. The dry pods are very light and blow about easily. Flowers about 1.5 cm. long, dull-purplish to dirty-white, with the tips inclined to be purplish but the banner nearly always white, capitate, rarely 12, nearly sessile and with the ovate bracts much longer than the pedicels. Banner water-lined, oblong-oval, about 8 mm. long, arcuate abruptly beyond the calyx teeth to 45 degrees, the sides reflexed near the base to 1 mm.'s width and so making the blade seem fiddle-shaped, deeply notched and with groove nearly V-shaped and 2 mm. deep and 1 mm. wide below, then becoming 2 mm. wide and U-shaped above and vanishing at tip. Wings linear-oblong, a little arcuate, notched below the tip, blunt, close-pressed and convex to keel below and then spreading and horizontal above, pink-purple and striped, 1 mm. wide. Keel sharply arched in the middle to erect and with erect part about 3 mm. long and as long as the base which is straight and with rounded tip, about 1 mm. shorter than the wings which are 2-4 mm. shorter than banner. Calyx about 7 mm. long and 2 mm. high, cylindrical, obliquely-triangular at base and inserted in line with it, the upper side a little arched, laterally flattened, cleft deeper above and oblique at tip, inclined to be nigrescent and densely appressed pubescent, teeth triangular, about 1 mm. long. Peduncles from spreading to flat on the ground, rarely 5 cm. long in flower or 7 mm. long in fruit, normally shorter than the leaves, rather stout, scapose. Leaves 3-8 cm. long, with coarse and persistent petioles mostly twice as long as the rachis. Leaflets 3-5 pairs, normally oval-obovate, sometimes elliptical to oval, acutish, nearly sessile and thick, 5-10 mm. long. Stipules densely imbricate, triangular-ovate, 5-8 mm.

long, hairy. Crowns several to many, very compact and short, the whole forming a dense mat. Whole plant hoary with very dense and closely appressed pubescence of slender, round and finely warty hairs attached by the middle. Common on clay mesas and in sandy washes from Price to Green River and southward at least to Ferron Utah in the Lower Temperate life zone.

173 *Astragalus Missouriensis* Nutt. Gen. 2 (1818). Pods about 2 cm. long, 7-8 mm. wide and 5 mm. high, abruptly stout-beaked, rounded at base, straight, rarely a little arcuate, minutely pubescent, strongly and finely cross-wrinkled only, with walls about 1-2 mm. thick when fresh and with the inner wall very woody, the outer skin inclined to peel off a little along the ventral suture but not thrown back nor wing-like when old, pods splitting at both sutures nearly to the middle and the whole length along the ventral suture when ripe and open at the end, inclined to be 4-sided with both sutures raised as keels, and somewhat obcompressed and with rounded edge and rarely sulcate ventrally, with beak scarcely at all flattened but subulate, cross-section nearly round and cavity a little inflated. Flowers about 1.5 cm. long, purple, 9-12. Banner about oval, nearly 1 cm. long, gently arched beyond calyx teeth to nearly erect, with sides reflexed about 2 mm. wide below and having an oblong outline, claw white. Wings nearly linear, a little arched, about 1 mm. wide, rounded, about 2-3 mm. longer than keel and 4-5 mm. shorter than banner. Keel the same as in *A. cymboides*, the erect part as long as the base, with nearly straight sides and abruptly upturned in the middle, about 4 mm. high and with rounded tip. Calyx tube about 7 mm. long, and 3 mm. high, nigrescent, short-cylindric, and with straight sides, somewhat laterally flattened, nearly truncate at base and inserted near the lower corner, somewhat oblique at tip and cleft a little deeper above, the subulate teeth spreading and about 2 mm. long. Pedicels short and stout, much shorter than the subulate-lanceolate bracts which are hyaline and hairy and about 5 mm. long. Peduncles stout, mostly erect, about 1 dm. long and longer than the leaves. Leaves not 1 dm. long, with petioles about as long as the rachis, rarely persisting long on the old stems. Leaflets about 5 (3-7) pairs, inclined to be acute at both ends and elliptical, 5-10 mm. long, somewhat thickened, strongly petiolulate, hoary with very fine and appressed soft hairs which are flattened in the middle and very warty and often twisted and attached near the middle. Stems short, an inch or so long, slender, with internodes seldom as long as the triangular and conspicuous but not large stipules, several from a woody root, and habit being more that of *A. argophyllus* but not hugging the ground closely. This species grows from Assiniboia and the Saskatchewan, through the Plains of Montana and Dakota southward to Kansas and New Mexico, Oklahoma and Texas, and westward to Santa Fee and the borders of the Rio Grande drainage at Farmington New Mexico and thence northward in the mountains of Colorado but not on the Pacific slope, common on the Laramie plains and northward through Montana to the foot of the Continental Divide but not apparently on the Pacific drainage, upper part of the Lower and lower part of the Middle Temperate life zones, in gravelly and well drained soil.

In the var. *cuspidocarpus* (Sheldon) the dorsal suture is sometimes produced a little and then is *A. Shortianus* var. *minor* Gray in part. This species is the eastern representative of the beautiful *A. amphioxys* but they never seem to occupy the same region. There is very little to separate this species from *A. amphioxys* var. *vespertinus* except the finely ribbed and straight and blunt pods, and leaflets inclined to be diamond-shaped, and the smaller flowers. This species appears to require the summer showers and cooler air of the Plains and blooms in May, while its congener of the Pacific slope blooms from March to early May and grows in a region with less humidity and few rains and higher temperature, and varies far more. *A. remulus* var.

Chloridæ is another close relative of this species growing in a still more arid region.

174 **Astragalus amphioxys** Gray Proc. Am. Acad. 13 336 (1878). This is a very variable species. The type has pods acuminate at both ends, and the tip tapering into a long and curved subulate beak, the pods often bent into a half circle, 5-8 mm. wide and high, or when much obcompressed 8 mm. wide and 2 mm. high, the cross-section then being oblong when fresh, and linear when dry, but cross-section normally nearly round when fresh and triquetrous when dry, that is, triangular-cordate, when fresh the surface is ashy and even, when dry it is smoothish from ventral suture about to the middle and then strongly reticulate-corrugated to the dorsal suture and along it from end to end, when fresh neither suture is evident but both are very thin and sharp and raised externally along the edges and much thickened underneath when dry, when pods are only a little arcuate and scarcely sulcate dorsally the cross-section is inclined to be 4-angled as in *A. cymboides* and *Missouriensis*, and with the same rounded sides, but normally it is so sulcate dorsally as to be triquetrous, walls about 2 mm. thick, neither the outer nor inner skin woody when fresh, thin-cartilaginous when dry, not mottled normally but green, rarely old pods show mottling. Flowers in the type rather narrow and nearly 3 cm long, loosely short-spicate, rarely 10. Banner oval, gently arched beyond the calyx tips from 10-60 degrees or rarely more, with sides reflexed 2-3 mm. wide below the middle giving it an oblong to triangular outline, groove very wide and shallow and often 7 mm. wide, white spot truncate above to obcordate and oblong to cuneate and ragged above with little purple veinlets and stippled, blade darkest near the white spot and fading out toward the edges. Wings linear to oblong-lanceolate, rounded and obtuse, oblique, ascending, concave to keel but turned out at its tip and horizontal and with their tips declined and conniving over the keel, 2 mm. wide, 1-2 mm. longer than keel 4 mm. shorter than banner. Keel about 7 mm. long, abruptly and a little arched above the middle to erect, or nearly so, the tip triangular and obtuse but not much rounded, 3 mm. high. Calyx tube 7-10 mm. long and 4 mm. wide, the upper side arcuate a little, the lower side straight, obliquely triangular at base and attached in line with it and cleft deeper above, a little narrowed at tip and somewhat laterally flattened, cylindrical, ashy or variably nigrescent with close-pressed hairs, the triangular-subulate teeth equal, a third to one fourth as long as the tube, ascending. Pedicels almost none, very stout. Bracts triangular, about 1 cm. long, hairy. Peduncles 5-15 cm. long, rarely as long as the leaves, rather stout and strict, the fruiting rachis, short and pods few. Leaves 1-1.5 dm. long, narrow, the leaf-rachis rather longer than the petiole. Leaflets elliptical to oval, inclined to be acute at both ends, rarely obovate and diamond-shaped, petiolulate, rather distant, 5-10 pairs, not much thickened. Stems rather slender, rarely 1 dm. long, zigzag. Stipules rarely overlapping, deltoid to triangular, seldom 1 cm. long, adnate, not connate. Plants mostly biennials but blooming the first year as winter annuals, with straight and fleshy tap root which is elongated and slender and which at tip is branched into a few crowns. A very early bloomer and not continuing long. Pods easily scattered by the wind, opening both at tip and base for a short distance. This species though with less easily blown pods than the former two species is common throughout the Navajo Basin from the base of the Uintas to Steamboat Springs Colorado and southward to the Mogollons and the Little Colorado at least to Winslow, and extending over on the Rio Grande but rare as far as El Paso Texas, throughout the plateau of northern Arizona and down its southern flanks to Prescott and around the western flanks, also extending down the Colorado through the Grand Canon and westward at least to the Charleston Mts. and northward to Moapa Nevada and

St. George Utah. Lower Temperate life zone and going a little into the Tropical, growing on gravelly soil on mesas in open places. The whole plant is hoary with closely appressed pubescence and the stems are about prostrate.

In the same region where the two species overlap in Nevada this hybridizes with *A. Layneae*, *A. amphioxys* X *Layneae*, with the pods of *amphioxys* and the flowers and somewhat woolly fine pubescence of *Layneae*, peduncles 1.5-2 dm. long and with rachis often 1 dm. long. Calyx nigrescent and 5 mm. long, 3 mm. high, short-cylindric, cleft deeper above and with unequal teeth, horizontal. Pods rather shortly acute at both ends, about 3 cm. long, about the same as the variety *vespertinus*, dorsal suture not intruded. Chimihuevis Mts. Arizona (south of Franconia) and my No. 5010 from the copper mine west of St. George Utah, April 4 1894. Some of the plants are clearly 3 years old. The flowers are rather short and stubby, about 2 cm long, the banner not much longer than the wing, the keel broad.

Astragalus amphioxys var. *vespertinus* (Sheldon Minn. Bot. Stud. 9 150 1894 as species). This is a form hardly deserving varietal rank, with pods about 3 cm. long, narrowly oblong and mostly straight, with the coatings inclined to separate along the ventral suture as in *A. cymboides* and with the dry cross-section inclined to be quadrangular, the pods with triangular-acute tip and a little narrowed but not acuminate at base. Leaflets not many and fewer pairs, obovate and obtuse. Peduncles normally longer than the leaves. Calyx teeth often 2 mm. long. Conspicuous as are the extremes among the forms of this species there is every gradation in all the characters in the same soil and locality. This variety is the common form on the clay slopes and mesas of the Navajo Basin. Coville's plant from the Panamint Mts. is probably something else.

Astragalus amphioxys var. *cymbellus* N. Var. Low and nearly acaulescent winter annuals. Leaflets from elliptical and acute to broadly obovate and strongly apiculate, 3-6 pairs. Flowers large, white or pink-purple, about 2 cm. long, narrow, with calyx teeth about one fourth as long as the tube. Pedicels short and stout. Bracts lanceolate, hyaline, 4-6 mm. long. Banner oval. Wings linear and purple-tipped. Pods oblong to narrowly so, shortly acuminate, narrowed and rounded below, about 2 cm long, and 8-15 mm. wide, nearly round when fresh or a little oblate, with a very firm and woody inner wall and a very soft outer pulp which is transparent and nearly 2 mm. wide, and with the outer skin very thin. The ventral suture extends through the pulp as a thin ridge, the dorsal suture also but very narrow. The seeds are horizontal and the cavity smooth within. When dry the pod is deltoid to diamond-shaped in cross-section, with both sutures very much raised and thickened especially the ventral, the sides being very convex along the middle. At maturity and when very dry the outer skin splits away from the inner along the ventral suture throughout and becomes explanate giving the pod an oval appearance. The pulp when dry is often represented by a cellular paper like that of a hornet's nest which fluffs up along the border and inside of the very thick sutural rims. The seed pedicels run through to the outer skin and appear as teeth on the rim. Sutures not intruded. Common in the San Rafael Swell and the western side of the Navajo Basin generally on clay slopes and benches. It connects with the species by all sorts of intergrades. The ventral suture varies from much more to much less convex than the dorsal.

175 *Astragalus Newberryi* Gray Proc. Am. Acad. 12 55 (1876). The type of the species is the most congested and starved form, and is not at all representative of its normal form though very variable. Pods nearly 2 cm. long and 1.5 cm. wide, ovate to nearly globose, conspicuously inflated, quite oblique, often a little sulcate at base at both sutures and somewhat obcompressed, but laterally if at all flattened

above, ending in a short and conical and rather upturned beak, cellular-fleshy when young, coriaceous when dry, deeply cordate at base, fresh pods almost round in cross-section, very cellular and with closely appressed hairs, young pods thin and rather papery, not woody. Ventral suture a little intruded and thin, but both sutures inconspicuous. Flowers brilliant-dark-purple, fading to bluish, with tips darkest, about 2.5 cm. long. Banner oval-ovate, about 1.3 cm long, 3 mm. wide and arcuate to about 30 degrees in a gentle arc from calyx tips, with sides reflexed a little in the middle, with broad groove forming about a half circle and 3 mm. wide and 2 mm. deep then widening and shallowing to a mere groove at tip, white spot reduced to half a dozen white lines low down on each side of the mid-nerve and forming an oblong and truncate to obcordate area. Wings a little darker than banner, linear to near the ear, nearly 2 mm. wide and 1 cm. long and 2-4 mm. longer than keel, concave to keel and horizontal at tip as in *A. amphioxys*, mostly declined, rounded, much narrower than the keel and with tips mostly touching and one of them not flaring, sometimes there are 2 pairs of wings to a flower. Keel narrow, gently arched beyond the middle to 45 degrees or rarely more, with tip much rounded, about 2 mm. wide near tip, a little shorter than wings and 4-6 mm. shorter than banner, straight. Calyx reddish, a little inflated below and narrowed at tip, barely flattened laterally, the upper side a little arched, nearly truncate below and only a little obliquely inserted, about 1 cm long and 3-4 mm. high, white with very fine and rather long and loosely appressed hairs, the teeth 2-4 mm. long, subulate and rather lax. Bracts hyaline, hairy, subulate, 4-6 mm. long, twice as long as the stout pedicels. Peduncles hardly as long as the calyx (in the type), very stout, even the flowers not exerted beyond the leaves. Leaves short, rosulate, many, with petioles often so short as to be almost undiscernible, but generally conspicuous and longer than the rachis and stout. Leaflets 2-3 pairs, obovate, thick, apiculate, densely and closely appressed-hoary-hairy with fine hairs, shortly petiolulate, contiguous, 5-10 mm. long. Stipules ovate. Acaulescent plants with very thick crowns and closely imbricated stipules, forming very dense and small tufts, short-lived perennials from erect roots with few crowns. Pubescence soft and fine, rather long, dense, white, shaggy on the pods, with slender and somewhat flattened and warty hairs. The above is the type character only. It is a very variable species, the forms being due to shade more than any other ecological factor. It (the type) grows only in very open and warm places where the soil is inclined to be clayey and poor. Lower Temperate life zone, scarce in the southern part of the Navajo Basin, common from Richfield to Marysvale Utah on the Sevier and over to Cove Creek and less common to Pioche Nevada, Peach Springs Arizona and eastward to the Little Colorado.

***Astragalus Purshii* X *Newberryi*.** This hybrid has narrowed and curved pods, more slender petioles, smaller flowers, and rather loose pubescence. This grows on the Sevier.

***Astragalus Purshii* X *Watsonianus*.** This has the leaf and pubescence characters of the var. *Watsonianus* but the other characters of *Purshii*. This grows in eastern Nevada.

***Astragalus Newberryi* var. *Watsonianus* (Kunze) Jones** Cont. 10 68 (1922). *Tragacantha Watsoniana* Kuntze Rev. Gen. 2 942 (1891). *A. eriocarpus* Watson. Watson's type is an over-developed plant growing in the shade of the sagebrush, in which the peduncles and leaves were relatively much elongated. The pods are cordate-ovate and about 1 cm. long, with lunate-half-oval longitudinal-section and semicircular cross-section below, then it is abruptly contracted into a subconical beak half as long as the body and which is erect and very sharp, the pods are shallow-sulcate ventrally at base and somewhat but not conspicuously inflated as in the type species, and about half its size. the pubescence about 2 mm. long and spreading at right angles

and crisped but not woolly. Flowers narrow as in the type, blue-black when dry, about 3 cm. long, with the calyx a half longer than the blades and rather shaggy and with the soft hairs more spreading and inclined to be nigrescent or black, the subulate teeth often 6 mm. long, the flowers (about 5) are darker and with much deeper red than the pink-purple of *A. Utahensis* but resemble it very much but bloom nearly a month earlier and at the same time as *A. Purshii* which is very early. Bracts often half as long as the calyx. Peduncles and leaves about 1-1.5 dm. long. Petioles about twice as long as the leaf-rachis. Leaflets about 5 pairs, nearly oval, acutish at both ends, 1-1.5 cm long, greener but still very pubescent. Crowns oblong, several, 3-7 cm. long. By the side of these in the open and without shade grow forms with all kinds of variations but with leaves and peduncles short or peduncles and petioles almost none and with leaflets reduced in number and size. Common throughout the Great Basin from the base of the Wasatch to the Sierras and southward to Owen's Valley and the southern flanks of the Mogollons of Arizona, growing on dry benches and on slopes in the sagebrush and junipers, Lower Temperate life zone, never in alkaline soil nor on poorly drained flats. This is nearest to *A. Utahensis* but does not grow with it and is found at a lower elevation. It and *A. Purshii* grow together and they hybridize freely. It is easily separable from it by the coarse pedicels, straightish pubescence, large flowers, narrow keel and much wider pods. The hybrids are easily recognized and do not seem to persist. This blooms about 10 days before *A. Purshii*, beginning early in May at 6000 ft. alt. and proportionally earlier at lower elevations.

Astragalus Newberryi* var. *castoreus Jones Cont. 7 658 (1895). This is a form with leaves and peduncles about 5 cm. long, 3 pairs of leaflets about 6 mm. long, elongated petioles, nigrescent calyx, purple tipped flowers about 2.5 cm. long with keel tip nearly erect and 4 mm. high and much less rounded. Pods elongated-lanceolate, about 3 cm. long and abruptly bent (about one third the way up) to an erect flat-tish and elongated tip twice as long as the base. Calyx teeth triangular and about 2-3 mm. long. This grows at the copper mine 18 miles west of St. George Utah, a very rare form, No. 5006.

Astragalus Newberryi* X *Eurekensis. This is a very rare hybrid with diamond-shaped leaflets 1-2.5 cm. long, 2-3 pairs, minutely and rather sparsely pubescent with closely appressed hairs, slender peduncles and petioles not conspicuously persistent, the former shorter than the leaves which are 5-8 mm. long. Pods more sparingly hairy and obliquely-oblong-lanceolate and about 2 cm. long. Calyx nigrescent. Flowers purple-tipped. Lake Point Utah, No 1743, May 29 1880. Another collection much like it is from Richfield and has more oblong leaves and obliquely-oval and sparsely hairy pods about the shape of *A. argophyllus*. One would expect to find many specimens of this hybrid, but they are very rare.

175 ***Astragalus Eurekensis*** Jones Cont. 3 291 (1893) and 8 12 (1898) Pods acuminate-lanceolate, 2-4 cm. long, about 8 mm. wide and 5 mm. high, arcuate in the middle to over a half-circle generally, notched at base, sulcate ventrally and dorsally at base and toward the middle till the ventral suture touches the dorsal making the cross-section of pods linear, above the pods are laterally compressed toward the rather long and triangular tip, with pubescence loosely shaggy-silky with rather long hairs which do not conceal the brown surface of the strongly reticulated pods which are reddish till fully ripe, sutures raised as strong ribs, pods with base horizontal to ascending, a little narrowed below, mostly single to few at the ends of the slender peduncles which are decumbent and shorter than the leaves. Flowers cream-white with purple-tipped keel, appearing lurid-white when dry, about 2.5 cm. long, narrow, erect, 3-8. Banner elliptical to ovate and about 1 cm. long, strongly notched, gently arched beyond the calyx to

45 degrees, with sides reflexed at base about 1 mm. wide but not above, thick and rather fleshy below, the groove deep and half-round and waterlined, about 5 mm. longer than keel. Wings about 2 mm. longer than keel, linear, straight, about 1 mm. wide, with horizontal tips. Keel 7-8 mm. long, about 3 mm. wide, strongly incurved from near the middle to erect or nearly so at the tip which is blunt and rounded and about 4 mm. high. Calyx nigrescent with appressed black and spreading white hairs, with tube about 7-8 mm. long, a little inflated, somewhat narrowed at tip, nearly truncate at base and somewhat obliquely inserted, cleft deeper above, about 3 mm. high, with pubescence becoming shaggy and long and somewhat spreading, with teeth subulate, arcuate, black and 3 mm. long. Pedicels very short and stout, much exceeded by the triangular spreading bracts which are 3-4 mm. long. Peduncles 5-8 cm. long, slender, brown and like the petioles but a little thicker. Leaves many, rosulate, 5-10 cm. long, not very narrow, with petioles about as long as the rachis. Leaflets 3-6 pairs, oblong to narrowly elliptical, 8-15 mm. long, rather thin, shortly acute at both ends but sessile, not contiguous, thinly pubescent with closely appressed but rather long hairs, the whole plant with a kind of lead color. The crowns are mostly single and thick with innumerable old and brown leaf-petioles, the stipules narrow and rarely visible. Acaulescent. Roots slender, very long and erect. This very distinct species rarely hybridizes and yet is a close relative of *A. Newberryi* but has a much restricted range. It grows on sagebrush benches in the foothills under the shade of the bushes, rarely in the open when it is more condensed. Common in the Oquirrh Mts. Utah and westward to Detroit but not yet found in the Deep Creek Mts., southward to Cove Fort, Cedar City and Richfield, eastward from Eureka and Silver City to Nephi, but not yet found in the Wasatch. Lower Temperate life zone, in well drained gravel on slopes. This was referred to *A. Thompsonae* ("syrtilus") by Sheldon but it has little in common with it. It blooms in May.

177 *Astragalus coccineus* (Parry) Brandegee Zool. 2 72 (1890). *A. Purshii* var. *coccineus* Parry West Am. Sci. 7 10 (1890). *A. grandiflorus* Watson not Bunge. It is unfortunate that this magnificently flowered species cannot retain the name of Watson for its flowers are comparable only by the yellowish *A. giganteus* and the later *A. funereus*. Pods a little inflated, inclined to be sulcate below the middle at both sutures and obcompressed, the cross-section about round above, with the conical tip short and about as wide as high, pods about 3 cm. long and 1 cm. wide, oblong, a little wider above the middle, arched so that the tip is erect or a little more incurved, the base truncate, the sutures neither raised nor thickened, the walls 1 mm. thick when fresh, and full of pulp, seeds filling the cavity which is hairy within when fresh and with elliptical cross-section then. Flowers red, very narrow and with exerted claws (which are at least as long as calyx) and narrow blades, the whole about 3 cm. long. Banner elliptic-oval, about 1.5 cm. long, arched about 10 degrees in very gentle arc from calyx teeth to 7 mm. beyond where the groove stops and then straight to the tip, the sides reflexed about 4 mm. wide and most below giving the blade an oblong appearance, groove obovate and not over 7 mm. long, narrowed below, the cross-section about U-shaped, red-veined, it stops about 1 cm. below the tip and then becomes a mere line to tip which is flat and 8-10 mm. wide. Wings nearly 1.5 cm. long and 2 mm. wide, about parallel with the upper side of keel and straight, acute on the lower side of the end, the ear being as long as the rest of the blade and extending 1 cm. beyond the calyx tube, a little shorter than the keel. Keel somewhat obliquely oblanceolate, straight, triangular-acute, 4 mm. wide near the end and with the tip just a little above the middle of the end, about as long as banner. The petals are much like those of *Colutea*. Calyx hardly 1 cm. long, about 3 mm. high, the cross-section rather triquetrous with upper side 1 mm. wide

and the lower 4 mm. wide, almost straight, the lower side rarely a little concave, narrowed and cleft deeper above at the end, but teeth equal, rather truncate and equally inserted on the very short and stout pedicels, red, thinly shaggy with fine and spreading tangled hairs, ascending in flower and fruit. Bracts 3-4 mm. long, triangular, white-shaggy so as to be concealed by the hairs. Peduncles 2-3 mm. thick, coarsely sulcate, somewhat curved in fruit. Leaves with the white-shaggy petioles as long as rachis, the petioles and peduncles persisting long and closely imbricated below, with the rather small stipules concealed by the shaggy pubescence. Leaflets 3-5 pairs, hardly 1 cm. long, about elliptical, but a little narrower below, acutish at both ends and with the pubescence short-shaggy and somewhat appressed. The crowns few and often 5 cm. wide, longer than wide and forming a dense mat 2-4 dm. wide combined with the many leaves. Roots rather fleshy, erect and long. From the Panamint Mts. to the Colorado desert south of the Salton Sink, blooming in April. The stems do not seem to elongate at all, being represented by the thick crowns.

178 *Astragalus funereus* Jones Cont. 12 11 (1908). Pods decidedly inflated, about 5 cm. long, 1.5 cm. wide, broadly- to ovate-oblong, from nearly half-oval to lunate, hooked at the end, the ventral suture a little concave and the subulate tip ascending about 45 degrees and 3-4 times as long as wide, normally somewhat obcompressed at base and shallow-sulcate at least ventrally, with cross-section nearly round and with walls having scarcely any flesh and are chartaceous when dry and with cavity much larger than the seeds and without pulp. Flowers few, pink-purple-tipped, becoming bluish (and therefore naturally acid) when dry, about 2 cm. long, with the claws not exerted and about as long as the calyx or a little more. Banner oval-ovate and about 1.5 cm. long and 1.2 cm. wide, with sides reflexed 5 mm. wide in the middle to 45 degrees and arcuate in gentle arc to 45 degrees from calyx tip. Groove deeply V-shaped, fully 2 mm. deep and less than 1 mm. wide, abruptly widening 7 mm. below tip of banner, most of it deep-purple and veined with white on the edges, the white spot being present as a narrow band. Wings concave to keel, 3 mm. wide at base to the middle and then contracted to 2 mm. wide 4 mm. from tip, very blunt and rounded, a little declined, quite as long as keel. Keel that of *A. coccineus* but about 1 cm. long and 3 mm. wide and with tip 4 mm. high and a little arched and with the end nearly in line with the upper side and obtuse and rounded barely apiculate, the general outline being half-oblancoolate. The general character of the flowers is that of *A. coccineus* but shorter. Calyx tube about 7 mm. long and 3 mm. high and nearly as wide, a little contracted at both ends, nearly equally inserted, the upper side arched a little, not cleft deeper above, nigrescent-shaggy with rather long and spreading and very fine hairs. Bracts deltoid, hardly 3 mm. long, very hairy and inclined to be nigrescent. Peduncles very stout, about 3 mm. thick and 5-7 cm. long, arcuate, with 5-10 flowers, and with fruiting rachis 1-5 cm. long. Leaves rarely 5 cm. long, with slender petioles much shorter than their rachis. Leaflets about 8 pairs, oval and obtuse, rarely a little obovate, 5-8 mm. long, rarely 1 cm. long. Pubescence very dense and much tangled and almost woolly, or only wavy, but much tangled on the pods. Neither petioles nor peduncles persisting when old. Young plants rather acaulescent but older ones with rather slender and knotted stems often 1 dm. long, and with internodes longer than the deltoid and greenish stipules, and about as thick as the peduncles, white-hairy and prostrate. The plants form rather large mats. The roots are thickened, fleshy and short. It blooms early in April on clay ridges at Rhyolite Nevada, probably in the Charleston Mts., rare at Tonopah, and Darwin Cal.

179 *Astragalus Utahensis* (Torr.) T. & G. Pac. R. R. Rep. 2 120 (1855). Phaca mollissima var. Utahensis Torr. Stansb. Rep. 385 t. 2 (1853). Pods narrowly oblong but so long-woolly as to seem half-oval, about 2 cm. long, with the body 5-7 mm. wide but appearing 1.5 cm. wide, barely 3 mm. high, with the rather straightish but crinkled hairs about 4 mm. long and spreading almost at right angles. When stripped of the hairs the pods are found to be much obcompressed nearly throughout and arched to about one third circle, with tip very short and conical, with both sutures strong and a little raised, inclined to be broadly sulcate at both sutures, with acutish base, opening a little at tip, not inflated, and with seeds hard to get out (this and the wooliness being admirable adaptations for wide distribution), with cross-section oblong to reniform and narrow, with walls finely cross-wrinkled and coriaceous and rather thin when fresh but hard and with the outer wall fleshy and 1 mm. thick and the inner one woody, pods loosely attached to the calyx, ripe seeds olive-colored. Flowers 2-2.5 cm. long, bluish-purple when dry (therefore acid when fresh), about half a dozen on the floral rachis which even in fruit is seldom as long as the flowers. Banner 1-1.5 cm. long, oval, rather deeply notched, with sides reflexed 3-4 mm. wide below the middle, rather abruptly arcuate to 30-45 degrees just beyond the calyx tips and straight to the tip, the white spot broadly cuneate and tridentate or with a single acuminate tooth from the center of the rounded or truncate end and beautifully veined with narrow and nearly parallel purple lines running down to the base. Wings linear, about straight, a little larger above and rounded, nearly twice shorter than banner and horizontal beyond, 2-5 mm. longer than keel, rarely 2 mm. wide. Keel narrow, about half-spatulate with the end about 3 mm. wide, the purple tip being a little above the middle of the end as in *A. coccineus* but very obtuse. Calyx a little inflated and hyaline, reddish, with tube about 1 cm. long, 3-6 mm. wide, a little narrowed at both ends, cleft deeper above, the sides being about straight, inserted on the lower corner on a stout pedicel 2-4 mm. long, sparsely woolly and rarely nigrescent, teeth subulate and about 3 mm. long. Bracts narrowly triangular, very thin and hyaline, 5-10 mm. long. Peduncles stout, barely as long as the leaves, from 1.5 dm. long to very short, prostrate in fruit. Leaves narrow, from 1 dm. long to a few centimeters long and with the slender petioles shorter than the leaf-rachis. Leaflets about contiguous, about 8 pairs, softly woolly with short hairs, normally 1 cm. long, but in condensed forms hardly 3 mm. long. Stems densely matted, often forming masses 2 feet in diameter, from 1 mm. long or less to almost acaulescent and with the triangular to acuminate-lanceolate stipules imbricated or concealed in the white wool, elongated in the shade. This species is found mostly on south slopes in the sagebrush in gravelly places from the lower part of the Middle Temperate to the upper part of the Lower Temperate life zone, from Beaverhead Co. Mont. and the western part of the Green River basin Wyoming to the southern flanks of the Uintas to Price Utah and the eastern slopes of the Wasatch, and west throughout the Great Basin to the Sierras, southward at least to Marysville and Fish Lake Utah, Osceola and Tonopah Nevada, southward of the latter place it seems to be replaced by *A. coccineus* and *funereus*. It is common as far west as the East Humboldt Mts. Nevada. It begins to bloom in early summer and continues till frost. The pods are like a pellet of wool when dry and blow far, scattering the seeds widely because they rattle out so slowly. It thrives also on loose and dry sandy soil. Roots erect and rather fleshy but not long. This is the most beautiful flower in Utah.

180 *Astragalus inflexus* Douglas in Hook. Fl. Bor. Am. 1 151 1834 Pods 1.5-3 cm. long, 5-10 mm. wide, and rarely 3 mm. high, lanceolate to oval-ovate, occasional forms occur that are only 1 cm. long, from simply hooked at tip to arcuate nearly to a circle, sulcate ventrally

from the base to the middle, much obcompressed till the cross-section is nearly that of the figure ∞ , flattened dorsally to broadly sulcate in the middle, with sutures not intruded, abruptly rounded (rarely acuminate) at base and with a boss-like pseudo-stipe at the junction with calyx, coriaceous when dry and finely corrugated, when fresh the wall is 1 mm. thick with the inner part woody only, pubescence of pods from rather sparse and rarely 1 mm. long but spreading to dense and shaggy and woolly and 4 mm. long, tip of pod conspicuously flattened and prow-like and deltoid to triangular-acuminate and longer than wide, mostly green-edged, conspicuously different from those of *A. Utahensis*, short-spicate. Flowers brilliant-pink-purple, about 2 cm. long, in loose heads and becoming short-spicate in fruit. Banner oval-ovate, a little over 1 cm. long, with sides reflexed about 3 mm. wide below the middle, abruptly arched just beyond the calyx tips to 45 degrees and then straight to the tip, inclined to appear fiddle-like by the sides being reflexed at tip, with groove deep and large and 2 mm. wide and 1 mm. deep at keel-tip and then vanishing above, white-spot fan-shaped and filling the groove and coming within 2 mm. of tip and purple-veined. Wings linear, entire, concave to keel and with tip horizontal and with the concave side up, straight, deep-purple, about 3 mm. longer than keel and 4 mm. shorter than banner. Keel about 5 mm. long and 3 mm. high, arcuate sharply from near the base to fully erect at the rounded tip. Calyx tube about 1 cm. long, 4-5 mm. wide, not appearing inflated, cleft a little deeper above and with base a little narrowed and inserted on the lower corner at the fleshy end, reddish and thin, sparsely short-woolly, teeth 3-6 mm. long, often half as long as the calyx and from subulate from a deltoid base to filiform-tipped. Bracts equally variable and from about as long as the teeth to 1 cm. long. Peduncles stout and about 5-7 cm. long. Leaves narrow, 7-10 cm. long, the petioles rarely over twice as long as the lowest leaflet. Leaflets about 10 pairs, mostly contiguous, broadly to narrowly elliptical, acutish at both ends, rarely rounded at tip and somewhat obovate, about 1 cm. long when fully developed, softly silky-woolly with mostly rather long hairs. Stipules elongated, triangular-subulate. Stems zigzag, the internodes in the best developed forms being 1-3 cm. long and making the stems 1-2 ft. long, mostly prostrate. Stipules not imbricated. This species prefers sandy places on southern slopes in the Middle and Lower Temperate life zones in the Columbia Basin. It runs up the Missoula at least to Missoula Mont. and seems to pass over the Continental Divide to Helena though most of the higher altitude forms are the variety. It seems also to reach the Great Basin on the eastern side of the Sierras in northern Nevada. The type does not seem to reach above the great bend of the Snake river at Huntington though puzzling intergrades do. It blooms in early summer.

Astragalus inflexus* var. *glareosus (Douglas) Jones Cont. 10 62 (1902). *A. glareosus* Douglas in Hook. Fl. Bor. Am. 1 152 (1834). This is a form with pods inclined to be hooked at tip, with slender peduncles often 1 dm. long but sometimes very short, with stems so short that the stipules overlap or are closely imbricated, the many leaves with leaflets nearly linear to narrowly elliptical and very acute at both ends and rather distant and mostly sparsely long silky-woolly but the plants still with a greenish look. Throughout the Columbia drainage but most common along the Snake river to the Yellowstone Park, Middle Temperate life zone mostly. This blooms in April and May and grows in the sagebrush on well drained slopes and in open valley but not in alkaline ground. The form described by Nelson as *A. nudisiliquis* had old pods where decay had loosened the hairs on the pods which had separated from the skin leaving the pods smooth. It often occurs late in the season in *A. Purshii*, *Utahensis* and *desperatus*. This undoubtedly hybridizes with *A. Purshii* forming ***Astragalus Purshii*-x-*glareosus***, which has more hairy pods and lighter colored flowers.

181 *Astragalus Purshii* Douglas in Hook. Fl. Bor. Am. 1 152 (1834)
 This is a very variable species. The type pods oblong-oval to broadly ovate and lunate, very oblique or arched at least toward the tip, 1.5-2 cm. long, nearly 1 cm. wide, and 3-4 mm. high, with cross-section reniform, sessile and rounded at base, densely short-woolly-shaggy with short hairs rather closely felted and with other longer hairs which are about straight and 2 mm. long, the pubescence mostly concealing the surface but not the shape, or pubescence very rarely so short as to show the close and reticulated corrugations, broadly sulcate ventrally below and decidedly obcompressed to near the tip, flattened but almost never sulcate dorsally, rarely arcuate to one third circle, with both sutures thick and raised externally, with tip a little flattened when dry and deltoid and hardly as long as wide but very sharp and mostly erect, jointed to the calyx. Green pods very thick but growing thinner as they mature, completely filled by the large seeds and cutting like wood. Flowers 2 cm. long, dull-white, with purple keel, appearing a little yellowish when dry, the heads a little elongated and with rachis 2-3 cm. long, but with its internodes shorter than the bracts. Banner broadly elliptical, about 1 cm. long, with sides reflexed 2-3 mm. wide in the middle at length, rather abruptly arcuate from 35-45 degrees beyond the calyx, tips and then nearly straight to the end, fleshy below, waterlined and inclined to fiddle shaped. Groove 2 mm. wide and nearly as deep, narrowed and deeper below. Wings linear to oblong, abruptly narrowed beyond the ears, about 1 mm. wide, rounded, a little arched, 2-3 mm. longer than keel and nearly as much shorter than banner. Keel as in *A. inflexus*, that is, the erect part as long as base and abruptly rounded at least to erect, about 5 mm. long from the lower end to the bend, 2 mm. wide in the middle and 1 mm. wide at the rounded tip. Calyx tube about 1 cm. long and 3-5 mm. wide, inclined to be a little inflated, fleshy at base, triangularly and somewhat obliquely inserted, with upper side a little arched, softly and thinly woolly, with the teeth variable, but about half as long as tube and triangular-subulate. Pedicels 3-4 mm. long. Bracts linear-lanceolate or narrower, about 1 cm. long. Peduncles rather slender but variable and shorter than the leaves. Leaves narrow, 5-8 cm. long, rather dull, with appressed leaflets in 3-5 pairs, with petioles nearly as long as the leaf-rachis. Leaflets rather narrowly elliptical, acute at both ends and inclined to be folded, 5-15 mm. long, sparsely long silky-woolly but pubescence rarely dense enough to conceal the dark-green surface, somewhat strongly petiolulate and rather distant. Stems prostrate, slender but short and with the internodes rarely as long as the acuminate and elongated stipules. Plants forming close and rather small mats, the crowns much branched and with rather woody roots which are erect, shallow and slender. This species abounds throughout the Columbia Basin and nearly to the heads of all its streams as far up as the middle of the Middle Temperate life zone, also running over the eastern divide to the Laramie plains and probably to Helena Mont., and into the Great Basin in northwestern Nevada, but never in the low humidity regions of the Great Basin. This applies to type only as to distribution.

***Astragalus Purshii* var. interior N. Var.** This is the white-flowered form of the Great Basin with the densely matted stems forming thick crowns which do not elongate. Leaves rarely 5 cm. long. The leaflets 6-8 pairs, elliptical, acutish, 5-8 mm. long, more hoary than the type. Flowers 1.5-2 cm. long and with narrow, not noticeably inflated calyx. Calyx teeth a third to a quarter as long as the tube. Bracts and pedicels shorter. Banner hardly longer than the wings. Pods rarely over 1.5 cm. long, barely more than oblique, and with very short and inconspicuous tip mostly concealed in the dense wool which generally conceals the shape of the pods. Wings horizontal at tip. This is the common form of the low humidity regions of the Great Plateau in the mountains and foothills in gravelly or rocky soil from

North Park Colorado to Panguitch lake Utah and Pioche Nevada and westward to the Sierras and northward to the rim of the Great Basin. It grows throughout the Middle Temperate life zone and far down into the Lower. It reaches an alt. of 2000 ft. In the mountains it prefers rocky ridges, and in the valleys grows in the brush on gravelly slopes but not in the shade. It is one of the earliest bloomers, coming out along with *A. Newberryi*, a month earlier than *A. Utahensis*. Occasionally the flowers are tinged with pink or purple, but the leaflets are not obovate. *A. consectus* Sheldon is an intergrade between this and the variety *longilobus*, with obovate leaflets.

Astragalus Purshii* var. *longilobus Jones Cont. 5 269 (1893). This is a form with the brilliant pink-purple flowers of *A. inflexus* but the calyx teeth very variable. Stems matted-acauliscent. Calyx somewhat inflated. Peduncles rather stout and longer than the leaves. Pubescence loosely long-woolly and not matted. Leaflets hardly 1 cm. long, oblong-obovate, acute or obtuse, about 5 pairs, contiguous. Leaves rarely 7 cm. long. Pods those of the type and densely long-shaggy with hairs 3-4 mm. long. Bracts elongated. Intergrading forms occur with shorter calyx teeth, white flowers, and the narrow leaves of *Purshii*. This is the most common form from the Charleston mountains Nevada to the San Bernardino and Owen's valley of California and Hawthorne Nevada. It is readily mistaken for *A. inflexus* but is stemless and with the long peduncles and the very shaggy pods of *A. Purshii* and with its short keel.

Astragalus Purshii* var. *leucolobus Jones Cont. 5 270 (1893) and 10 61 (1902). This is a much branched and short-stemmed form with the internodes barely as long as the stipules. Peduncles longer than the leaves. Bracts and calyx teeth as in *A. Utahensis*, relatively short. Calyx inflated, broadly-oblong, and with the teeth hardly 1 cm. long, truncate below and inserted on the lower corner, loosely long-woolly as in *A. inflexus*. Flowers purple, stubby, hardly 1.5 cm. long, blades nearly equal. Leaves 3-7 cm. long. Leaflets about 6 pairs, oval to obovate, rounded, rarely acutish, mostly hardly 5 mm. long, though sometimes 1 cm. long and obovate. Pods oblong, conspicuously falcate, with short and felted wool hardly 1 mm. long, about 1.5 cm. long, with a long and subulate beak from an abruptly contracted base. This appears very distinct but it intergrades with the above. It is the prevailing form on the western side of the Sierras and San Bernardino. Lower Temperate life zone.

Astragalus Purshii* var. *tinctus Jones Cont. 5 269 (1893). This is a form with loosely branched but densely caespitose and slender stems sometimes a foot long but the season's growth rarely 1 dm long, the internodes rarely as long as the stipules and white-woolly. Peduncles about as long as the leaves. Flowers about 2 cm. long, purple, about as in *A. Utahensis* but with the keel of *Purshii*. Pods broadly ovate to broadly oblong, a little arched, 1-1.5 cm. long, a little sulcate ventrally, densely long-woolly as in *A. Utahensis*. Leaves rarely 1 dm. long. Leaflets about 4 (3-6) pairs, oblong-obovate and apiculate, about 1 cm. long. Calyx teeth normally subulate and half as long as the tube and the subulate bracts 1 cm. long, but teeth twice as short. This intergrades with the vars. *longilobus* and *lectulus*. It is the common form of the northern Sierras on both sides in the Middle Temperate life zone and running up a little into the Upper, among rocks and gravel in open places. Most common at Soda Spring near Summit Nevada Co. Cal. and Carson City Nevada, a form intergrading with this and *A. Purshii* grows at Tehachapi. This variety extends northward at least to Goose lake.

Astragalus Purshii* var. *lectulus (Watson) Jones Cont. 10 61 (1902) *A. lectulus* Watson Proc. Am. Acad. 22 471 (1887). This is the most reduced and remarkable form with the straggling stems of the var. *tinctus*, and white-woolly but still more slender and forming loose

mats. Peduncles slender, from almost none to 1-2 cm. long, about 3-flowered. Flowers purple, about 1 cm. long, the blades hardly 5 mm. long. Calyx teeth very variable but bracts and stipules elongated, the tube about 5 mm. long and 2 mm. wide. Pods broadly ovate, only obtuse, from 7 mm. long and lanceolate to arched into a circle and 1 cm. long, forming either a dense mass of wool or shortly and closely felted. Leaves nearly 3 cm. long, with petiole mostly longer than the rachis. Leaflets about 3 pairs, closely contiguous, cuneate-obovate, rounded and obtuse to apiculate, about 1 cm. long. This grows from Bear valley in the San Bernardino to Crook Co. Oregon and along the eastern slope of the Sierras, in gravel and sand, Middle Temperate life zone.

19 MALACI.

Pods narrowly oblong to nearly linear, partly to wholly 2-celled, inclined to be fleshy, not inflated, rather laterally flattened to conspicuously obcompressed, pubescent but never woolly, smooth in *A. succumbens*, sessile, 2.5-7 cm. long, mostly reddish and racemose, capitate in the *A. Parryi* group. Stems tufted, erect, spreading, with few internodes but never acaulescent. Peduncles about terminal. Calyx teeth and bracts inclined to be lax and long. Flowers large, about 2 cm. long. Calyx cylindrical and with teeth over half the whole. Petals broad, short-clawed. Leaves long and narrow, with many large, broad and obtuse to barely apiculate leaflets, and large and hyaline stipules which are not connate above. Perennials, except *A. succumbens*, not woody. Pubescence of leaves shaggy, puberulent and only ashy in *A. ensiformis*, and silvery and appressed in *A. Layneae*. The sections of this group though loosely related are nearer to each other than to other groups.

KEY.

A. Flowers capitate, few, white. Calyx almost as wide as long. The pods linear-lanceolate, much obcompressed, sulcate dorsally, acuminate, very fleshy, cartilaginous when dry, about 3 cm. long and 5 mm. wide. Plants densely pubescent. Compare this group with the *Sarcocarpi*.

Pods not 2-celled, shaggy.

182 *Parryi*.

Pods 2-celled, puberulent.

183 *Feensis*.

2A. Flowers shortly racemose and few. Pods broadly linear, round in cross-section when fresh, not sulcate, apiculate, 3-5 cm. long, puberulent, reddish. Plants only puberulent, with the habit of *A. cibarius*.

184 *ensiformis*.

3A. Flowers racemose, rather many. Pods acuminate, often sulcate, seldom fleshy, 3-7 cm long, mostly pubescent. Plants strongly pubescent. Leaflets from about oval to obovate and very obtuse, and very pubescent. Stipules large, narrow and acuminate.

Pods much laterally flattened, not long-acuminate, 6-8 mm. high, shaggy.

Flowers pink-purple. Pubescence shaggy.

185 *malacus*.

Pods not laterally flattened, long-acuminate, not over 3 mm. high, not shaggy. Flowers white with purple tips. Pubescence not shaggy.

186 *Layneae*.

4A. Pods linear, not acuminate, arcuate, much laterally flattened and with concave sides, deeply sulcate dorsally and 2-celled, the ventral suture raised as a thin wing, sessile and jointed to the calyx, papery, not inflated. Flowers about 2 cm. long, in short spikes. Pubescence loose, rather coarse, of hairs tapering from a pustulate base. Winter annuals of the Columbia Basin. Succumbentes.

187 *succumbens*.

182 *Astragalus Parryi* Gray Am. Jour. Sci. Ser 2 33 410 (1862).

Pods broadly sulcate ventrally, and narrowly and deeply so dorsally, much obcompressed and with dorsal suture a little produced, falcate to a half circle often, with cross section about reniform or obcompressed to that of the figure ∞ , finely longitudinally- and cross-lined, with walls 1-2 mm. thick when fresh, densely short-hoary when young and long-shaggy when old. Flowers 6-10, 1.5 cm. long, wide. Banner about reniform and deeply notched about 1 cm. long, with very short claw, abruptly arcuate at end of calyx tube to nearly erect, the sides much reflexed below to 3-4 mm. wide, finely and faintly purple-lined with branching veins. Wings oblanceolate and much rounded, about 3 mm. wide at tips, sometimes arched to nearly erect, often tinged with purple, a little longer than the keel, 2-6 mm. shorter than banner. Keel about 7 mm. long and 3 mm. high, abruptly arcuate to erect and with rounded tip which is 3 mm. wide and with a purple spot at the very end. Calyx tube 7-8 mm. long, 4-7 mm. wide, a little inflated, inclined to be a little spurred above at the end and quite oblique but attached near the middle of the fleshy end, papery, long shaggy-hairy, mostly whitish but sometimes nigrescent, with subulate teeth about as long as tube and rather lax. Pedicels stout in fruit, 3-4 mm. long, ascending. Bracts green and hyaline, 4-10 mm. long, triangular. Peduncles shorter than the leaves, rarely 1 dm. long. Leaves 5 cm. to 2 dm. long, the lowest very much reduced, and with very small round and often notched leaflets, the uppermost leaves with elliptical leaflets 1-1.5 cm. long and apiculate to retuse. Petioles rarely a third the whole, tapering as well as the long rachis. Leaflets rather distant, 10-12 pairs, nearly smooth above, long shaggy hairy below, but pubescence sparse except on young parts or on plants growing in specially dry places. Upper stipules triangular and about 1 cm. long, green or hyaline below, the lower ones short and wide. Stems rather thick and succulent, often a foot long and with slender internodes, spreading from a rather much branched and woody crown. This grows among rocks in rather moist canons and blooms in late May and June. Middle Temperate life zone. From southern Wyoming on the headwaters of the Platte to central Colorado and the Sangre de Cristo range on the Atlantic slope only, a species of very limited extent.

183 *Astragalus Feensis* Jones Cont. 8 20 (1893). Pods about 3 mm. wide, and high, minutely puberulent, with cross-section triangular-cordate, with dorsal suture sulcate and intruded fully to the ventral as a white partition. Flowers unknown. Calyx tube about 4-5 mm. long, teeth shortly pubescent triangular, much shorter than the tube. Bracts minute. Pedicels very short. Peduncles slender, about 7 cm. long and about as long as the leaves or more. Leaves about 5 cm. long, many, with petioles fully as long as the rachis. Leaflets 7-8 pairs, oval, 5-7 mm. long, rounded to notched, densely appressed-hairy. Old leaf-petioles persistent. Stems tufted, very short. Whole plant densely appressed-hairy. This was collected only by Fendler, No. 151, on gravelly hills at Santa Fe New Mexico, May 28 1847. Lower Temperate life zone.

184 *Astragalus ensiformis* Jones Cont. 7 658 (1895). Pods about 6 mm. high, and 3 mm. wide when fresh, but much laterally flattened when dry, fresh walls 1 mm. thick and soft and a little sulcate on the ventral but not on the dorsal side, when dry both sutures are raised and thick making the reflexed pods appear vetch-like. Pods arched to one third circle, abruptly contracted but obtuse at both ends, the stout mucro at tip an extension of the ventral suture, dorsal suture produced as a thin partition and reaching almost to the ventral, fresh cross-section cordate-ovate, cavity filled by the seeds. Flowers like those of *A. cibarius*. Pedicels short. Bracts ovate, about 3 mm. long. Peduncles about 1 dm. long, rather shorter than the leaves. Leaves few on the short stems, about 1.5 dm. long. Leaflets 6-8 pairs, green, oval to oblong, 1-1.5 cm. long, obtuse, almost contiguous, smooth

above and hoary below as also are the stems. Stipules large and very wide, veined, smooth, nearly 1 cm. long, sheathing below. Stems few prostrate to ascending, slender, hardly 1 dm. long. Peduncles and petioles with white, short, narrow hairs closely appressed. This was found growing among the junipers and pinons at the head of the Grand Wash south (and a little west) of St. George (Utah) in Arizona on the gravelly mesa. Lower Temperate life zone. It so closely resembled *A. cibarius* that I only collected a few specimens to show the locality. This place was above Pagumpa, the Wash joins the Colorado at the abandoned Pierce's Ferry.

185 *Astragalus malacus* Gray Proc. Am. Acad. 7 336 (1868). Pods 3-5 cm. long, shortly stipitate, much laterally flattened, about 7-8 mm. high and 2 mm. wide, chartaceous and but little fleshy, nearly straight to strongly arcuate, 2-celled except at very tip by a hyaline partition, but sulcate ventrally, and with that suture rather thick and raised, narrowly sulcate dorsally to the tip, sparsely shaggy with hairs 1-3 mm. long which are spreading at a right angle, usually mottled on the surface, with cross-section linear-triangular, rather abruptly acuminate at tip into a flat and upcurved beak which varies from several times longer than wide or shorter or sometimes even deltoid, at other times with very long and subulate beak, papery when dry, densely set. Flowers about 2 cm. long, pink-purple on the blades, spreading and rather densely spicate. Banner oblanceolate, 7-10 mm. long, abruptly arched beyond the calyx teeth to 30-45 degrees, with sides reflexed 1 mm. wide in the middle, about 3 mm. longer than keel, white spot large, purple-veined. Wings linear, barely longer than keel, somewhat arcuate, about 1 mm. wide, and with rounded and horizontal tips. Keel about 5 mm. long, with straight base and then abruptly arched to erect, 3 mm. high, with tip blunt and rounded or truncate. Calyx tube about 7 mm. long, with sides about straight, almost truncate at base and thick and rather obliquely inserted, very thin, nigrescent, and shaggy with long and spreading hairs, cleft deeper above, laterally flattened. Calyx teeth subulate, about 2-4 mm. long. Pedicels almost none. Bracts subulate-lanceolate, from half to nearly as long as the calyx, hyaline, long-fringed. Peduncles stout, about 1 dm. long and hardly as long as the leaves, the floral rachis so short at first as to put the flowers in heads and then elongating with age. Leaves 1-2 dm. long, with stout and tapering petioles and rachis, the latter the longer. Leaflets 7-10 pairs, elliptical to oval, 1-2 cm. long, green or dark, with long and shaggy spreading hairs like the stems, peduncles and calyx, with fine hairs which are somewhat flattened and twisted and from an enlarged base. Stipules very thin and hyaline and green-veined, triangular-acuminate, 1-1.5 cm. long, adnate, not connate. Proper stems rarely a foot long, with few internodes, the upper one rarely 8 cm. long, tufted from the few and woody crowns. Pubescence variable from 1-3 mm. long. Plants growing in good gravelly soil on benches in the sagebrush, Lower Temperate life zone, throughout the western part of the Great Basin and southward to the Mojave desert, northward to the rim of the Basin and Stein's Mt., eastward but a short distance from the base of the Sierras, Owen's valley Candelaria Nevada and the Blue Mts Oregon, and up the Snake river in the Columbia Basin from Huntington to Glenn's Ferry.

***Astragalus malacus* var. *cbfalcatus* (Nelson).** *A. obfalcatus* Nelson Bot. Gaz. 54 411 (1912). This is a robust form (hardly deserving varietal rank) with much larger leaves. Pods falcate, 3-4 cm. long, 6-8 mm. high, 3-4 mm. wide, long-acuminate. Calyx lobes about as long as tube. Bracts with long and capillary tips. Leaflets 2 cm. long. Plants about a foot high. Intergrades also occur. From Foise to Huntington. This was first found by Cleburne at Weiser in 1883, then by myself there and at Glenn's Ferry about 1903.

186 *Astragalus Layneae* Greene Bull. Cal. Acad. 3 156 (1885). Pods 3-5 cm. long, arched even to a circle at times, long-acuminate, narrowed below and short-stipitate, when fresh, somewhat fleshy, with walls 1 mm. thick and with cross-section about reniform, when dry the pods are triquetrous and very broadly sulcate dorsally from the base toward the tip but conspicuously flattened laterally above, the dorsal suture intruded about half way but not as a thin partition, being simply unchanged sides of the sulcus united for a space 1-2 mm. wide, to the middle at least, where the pods are 1-celled to the tip, pods mottled, shortly and thinly appressed-hairy, to almost smooth, with ventral suture raised and thin externally, sometimes the pods are completely compressed and with linear cross-section, they are then very falcate, they are reflexed or ascending. Flowers conspicuously white and with only the tips purple, 1.5 cm. long, racemose, many, rather stubby. Banner mostly white, about 7 mm. long, oval-ovate, with sides reflexed 3 mm. wide below, abruptly arcuate to 45 degrees just beyond calyx, with sides reflexed to the tip making the blade appear triangular, the very tip purple or purple-veined, white spot obcordate and striate, the groove V-shaped and 2 mm. deep and reaching the tip. Wings linear-cuneate, a little over 2 mm. wide, at tip, rounded, straight or a little arcuate, concave to keel, with tips meeting, about half as wide as keel, purple 3 mm. back from tip. Keel straight, about 5 mm. long, abruptly erect and 3 mm. high, the tip dark and deltoid. Calyx almost campanulate, hardly 5 mm. long and 4 mm. wide, the upper side arched and the lower straight, truncate below and inserted near the corner on a very short and stout pedicel, dark with short and appressed hairs, thin, with teeth black, triangular and about 1 mm. long. Bracts ovate to ovate-lanceolate, barely 4 mm. long, sparsely hairy above. Peduncles stout and strict, from shorter than the leaves to much longer, 1-3 dm. long and with the floral rachis nearly as much more. Leaves with short petioles which are about a third the whole and stout but tapering but little. Leaflets about 6-8 pairs, hardly contiguous, oval, about 1 cm. long, long-petiolulate, sometimes notched, rather closely appressed-puberulent with tangled and long hairs and inclined to be silvery. Stipules deltoid or very broad, rarely 1 cm. long. Proper stems from almost none to a foot long, very zigzag (that is bent abruptly at each node, in distinction from flexuous which can mean bent between the nodes), with internodes rarely 2 cm. long, several from slender root-branches. Leaves mostly flat on the ground. This grows on the gravelly desert benches in the lower part of the Lower Temperate life zone, blooming in April, and seeming to thrive best in rather sandy places. From Chloride Arizona to Amargosa desert and westward to the Sierras.

Astragalus amphioxys* x *Layneae This is a hybrid occurring on the eastern border where it has the pods of *A. amphioxys* but either wholly 1-celled or partly so and more fleshy than *Layneae*, and with the leaves and flowers of that species.

***Astragalus malacus* x *Layneae*.** This is a rare hybrid on the western border with the flowers and pubescence of *A. Layneae*, and pods varying toward *A. amphioxys*.

187 *Astragalus succumbens* Douglas in Hook. Fl. Bor. Am. 1 151 (1834). Pods about 4 cm. long, 5 mm. high, and 2 mm. wide, with the cross-section linear-triquetrous, ascending (but the calyx nearly horizontal), arched to about one third circle, splitting the calyx, many, spicate, delicately cross-nerved, with declined and short tip. Flowers ascending, nearly white and with pink-purple base. Banner oblong-ovate, about 8-10 mm. long and 7 mm. wide, very deeply notched and water-lined, with sides not reflexed, gently arcuate at calyx tips to erect, groove U-shaped below and widening to nothing above and filling about one third of the banner. Wings almost straight, as long as banner and very conspicuous, 3-4 mm. wide, rounded, lacerate at tip,

half-linear-elliptical, convex to keel at base, then a little flaring, white but pink-tinged, 6 mm. longer than keel. Keel oblong, about 5 mm. long, 2 mm. high below and with large ear, a little higher at tip and 3 mm. high, the base straight nearly to the end and then sharply rounded to erect, the very tip a little outwardly turned and barely obtuse, deep-purple at tip, wings and banner transparent. Calyx cylindrical, a little inflated, much laterally flattened, with straight base and with the upper side arched a little, cleft deeper above, oblique at base and inserted near the lower and fleshy corner, very thin and hyaline, sparsely and spreading-pubescent with long white and black hairs, pink-tinted above, 5-7 mm long, 3 mm. high, with teeth green, lax, triangular and about 3 mm. long. Pedicels stout and 1-2 mm. long. Bracts falcate, hyaline, hairy, linear-subulate, about 1 cm. long. Stipules similar but green and rather rigid and with broad base, about 1 cm. long, spreading, not connate, the lowest deltoid and very short. Peduncles stout, axillary about 5 cm. long, spreading, with the tapering rachis a little longer. Leaves hardly 1 dm long, narrow, spreading, with short petioles and tapering rachis. Leaflets 6-8 pairs, from oval-obovate to narrowly obovate, 1-1.5 cm. long, rounded, apiculate, appearing as if ashy but really of short-shaggy, fine, spreading hairs. The stems are much branched below, very zigzag, from slender to stout, rarely 4 dm. long, the central one erect or nearly so, the lateral ones nearly flat on the ground. This grows in sand and on rocky hill-sides in the center of the Columbia Basin near Walla Walla, Umatilla, Klickitat, and is reported from Baker City. Lower Temperate life zone, blooming in June. This unique plant at first thought appears more related to the Galegiformes than any other, and connecting that group with the Hamosi, the pods very much suggesting that on a large scale, but clearly this group plant is an offshoot of the Malaci.

20 MOLLISSIMI.

Densely tufted perennials of dry plains, mostly with scapose peduncles, with pods nearly 2-celled except at tip, with walls rather fleshy to coriaceous, pods inclined to be somewhat inflated, with cross-section cylindrical to a little obcompressed, rather sulcate ventrally, mostly straight, oval to oblong or rarely broadly linear, never very small, never reflexed, sessile, mostly felted- or snaggy-pubescent. Flowers spicate, mostly cream-colored, rarely red, large. Pedicels almost none. Pubescence attached by the base, mostly shaggy or felted and inclined to turn yellowish in age. Leaves narrow and with many flat and rather thick leaflets. *A. anisus* has broad leaflets and hairs fixed by the middle.

KEY

- A. Pods ovate to cylindrical or linear, mostly narrow.
- AB. Pods shaggy or velvety, rather thin-coriaceous, seldom inflated, conspicuously oblique or arcuate, sulcate at both sutures, with truncate to cordate base. Leaves with rather large leaflets which are almost never acute, narrow nor obovate. Pubescence of kinky and jointed hairs which are appressed except on the calyx of *A. Bigelovii*.
- ABC. Calyx loosely shaggy. 188 *Bigelovii*
- AB2C. Calyx closely appressed-hairy. Pods straight, densely hairy, with sides even and straight. 189 *Phoenicis*
- AB3C. Pods, calyx and leaves with close and felted pubescence of tangled hairs, pods with uneven sides. Leaflets inclined to be acute. Flowers narrow. Bracts short. This group blooms early and continues till fall according to the rains. 190 *Humboldtii*
- A2B. Pods smooth, ascending, slightly corrugated, cartilaginous, obcompressed, inclined to be sulcate at both sutures, arcuate or oblique, 1-2 cm. long. Flowers 2-3 cm. long, mostly greenish-yellow, spicate, about horizontal or even reflexed, but nearly erect in fruit, many, not conspicuously stubby. Calyx teeth subulate and about half as long as tube. Leaflets of rather many pairs, large. Stems ascending to erect, often tall. Pubescence fine, tangled and rather dense.
- Pods nearly linear, not inflated. Flowers purple. 191 *mollissimus*
- Pods broad and inflated. Flowers ochroleucous. 192 *giganteus*
- 2A. Pods conspicuously inflated, nearly globose.
- 2AB. Pods straight or a little arcuate, ovate to globose, large, scantily pubescent, with rugose sides. Pubescence of calyx short and felted. 193 *Orizabae*
- 2A2B. Pods about globose, 1.5-4 cm. long, rounded and apiculate at tip, with a minute boss at base, minutely pubescent. Pod, 1.5 cm. long. Small plants, with 3-6 pairs of small leaflets. Pubescence attached by the middle. 194 *anisus*
- Pods 3.5 cm. long. Large plants, with 12-15 pairs of large leaflets. Hairs attached by the base. 195 *orthanthus*

188 *Astragalus Bigelovii* Gray Pl. Wr. 2 42 (1853). Pods oblong-oval to ovate, oblique and barely arched, about 1 cm. long though varying from 7 mm. long to 2 cm. long, ovate in the type, about 7 mm. wide and 5 mm. high, sulcate deeper above, shortly-triangular-acute with upturned, tip cross-section from circular to oblate with septum variable but hardly reaching the ventral suture throughout. The pods vary greatly from much inflated and almost as broad as long to much narrower and elongated, the pubescence is shaggy and rather short. Flowers densely spicate, purple and showy, rather broad and with the claws not exerted, about 2 cm. long, but the petals inclined to be rather stubby. Banner arcuate to about 80 degrees in a gentle curve, the sides reflexed much and 3 mm. wide below but not much at tip so that the banner seems oblong, groove 2 mm. deep and nearly as wide being broadly V-shaped and continuous to the tip, white spot filling groove and coming within 2 mm. of tip and narrowly-oblong, banner notched and purple tinged with edges rose purple and base darker. Wings linear, about 2 mm. wide, with a little lobe at base on the upper side, obtuse, 1 mm. longer than keel to nearly as long as banner, mostly 2-4 mm. shorter than banner which is about 7 mm. long, ascending 30 degrees, dark-rose purple at base, the upper 4 mm. white, nearly flat, the tip a little incurved. Keel dark purple tipped, blunt, gently arcuate from near the base to one third circle or sharply to a half circle and then 3-4 mm. long and high. Calyx pink, a little inflated, becoming narrower and white with age, shaggy with spreading hairs, laterally flattened, gibbous, ascending, with tube about 7 mm. long and 4-5 mm. wide, with subulate teeth about half as long as tube. Bracts persistent, rather large, from 4-10 mm. long. Peduncles stout, erect or declined and scapose, 5-20 cm. long, mostly shorter than the leaves, the fruiting rachis about as long as the peduncle. Leaves 7-20 cm. long, with petioles as long as the rachis. Leaflets nearly round to oval, very obtuse, about 12 pairs, 7-20 mm. long in the type densely shaggy with yellow hairs. Stems normally almost none and with the thick crowns sometimes a little produced and woody and with closely imbricated stipules which are 1-2 cm. long. This very variable species is common in the Rio Grande valley and westward at least to Flagstaff Arizona and the Santa Ritas and to Monterey and Durango Mexico. It grows mostly in the Lower Temperate life zone, going down a little into the Tropical, in gravel on dry benches, in the open and blooming in early spring.

***Astragalus Bigelovii* var. *Matthewsii* (Watson Proc. Am. Acad. 18 192 1883 as species).** This differs in no respect from the type except that the flowers are loosely spicate, the bracts green and lanceolate and longer, and the pods are about 1.5 cm. long and conspicuously inflated and chestnut-shaped, nearly as wide as long and about half as high. Fort Wingate New Mexico on the Little Colorado in the Navajo Basin.

***Astragalus Bigelovii* var. *Thompsonae* (Watson) Jones Cont. 8 23 (1898). *A. Thompsonae* Watson Proc. Am. Acad. 10 345 (1875) as species.** Pods ovate to acuminate-lanceolate, 1-3 cm. long, conspicuously arcuate normally to a half circle, hardly 1 cm. wide and rarely 7 mm. high, decidedly obcompressed and with cross-section about that of the figure ∞ , with tip 1-celled a distance of 4-7 mm. down, shortly velvety-shaggy, with walls about 2 mm. thick when fresh. Flowers rather light-purple and with lighter bases, about 2 cm. long, loosely spicate. Banner arched abruptly at calyx tips to 45-75 degrees, appearing fiddle-shaped, with sides reflexed a little below, with white spot finely stippled and notched and obovate. Wings horizontal at tip and rather narrower. Calyx tube 7-10 mm. long, teeth rarely over one third as long as tube and often black-shaggy. Bracts often nearly as long as calyx. Peduncles rarely shorter than the leaves, often 2 dm. long, stout, ascending, with many flowers and ascending pods. The

leaves acuminate. Leaflets gradually smaller, often 20 pairs, with the pubescence very fine and inclined to be shaggy-woolly and white but the dark-green of the leaves not wholly concealed. About stemless, with several thick crowns from the thick and fleshy root, not at all woody. This form is even more beautiful than the species, but it intergrades at all points. It is a better developed form and is never yellow and has much longer pods. It grows in a more arid region, showing that the species of the Plains (the type) is near its eastern climatic limit, and is better adapted to more western regions. This is also evident from the fact that western forms are more specialized. Throughout the Navajo Basin from the base of the Uintas to the Wasatch and Chepeta Well (Colorado) east of Vernal Utah, southward through Mancos and Farmington New Mexico and westward along the Colorado to Pioche Nevada, and northward through Wa Wa (west of Frisco) and as far as Cottonwood Spring west of St. John Utah on the desert side. Lower Temperate life zone in sandy and loose gravelly soil, apparently not growing on the Sevier though to be expected.

189 *Astragalus Phoenicis* Jones Cont. 8 12 (1898). Pods cylindrical or nearly so, 2 cm. long, 5 mm. wide and about 3-4 mm. high, narrowly oblong, straight, barely splitting the calyx, obcompressed a little, scarcely sulcate ventrally, the somewhat flattened beak triangular and a simple projection of the nearly straight ventral suture and not at all upturned, partition hardly complete even in the middle, pods finely and appressed and very short-pubescent, about a third longer than the calyx. Flowers horizontal to ascending. Banner oval, gently arched to 45 degrees from the calyx tips, the blade about 1 cm. long, with the sides reflexed 1 mm. wide, the claw rather long. Wings oblanceolate, gently arcuate, a little longer than keel and 2 mm. shorter than banner. Keel straight, the tip erect and blunt and gently arcuate from the base. Calyx tube about 7 mm. long and 3 mm. wide, nearly twice as long as the triangular teeth, densely appressed-short-hairy, a little wider below, rather truncate below and obliquely attached. Peduncles scapose, about 1.5 dm. long including rachis which is about one third the whole and rather loosely flowered, erect. Leaves 5-8 cm. long, silvery-silky with short and appressed hairs, the petioles half the whole. Leaflets 10-15 pairs, contiguous, oval, 7 mm. long, obtuse. Stipules broad, not over 1 cm. long, acuminate, puberulent. Stems caespitose, hardly 2.5 cm. long, covered by the imbricated stipules. Plants with the general habit of *A. amphioxys*. Northern Arizona. Palmer, Hillsboro New Mexico. Diehl. Lower Temperate life zone. This may be only a form of *A. Humboldtii*, but the pods are more symmetrical, it has the calyx of that species.

190 *Astragalus Humboldtii* Gray Proc. Am. Acad. 6 195 (1864). Pods oblong to oblong-lanceolate, 7-15 mm. long, about 5 mm. wide and 2-3 mm. high, arcuate, with sides inclined to be rugulose, closely felted when young and becoming smoother or even almost smooth when ripe, with the deltoid to triangular beak abrupt but stout and rarely oblique, nearly or fully 2-celled to a little above the middle and then 1-celled to tip as in the var. *Thompsoniae* above. Flowers purple or white, in oblong heads or short spikes, about 1.5 cm. long. Banner gently arched to 45 degrees or less beyond the calyx tips, with sides folded back to the midrib fully 3 mm. wide opposite the keel and less so above and giving the banner an oblong appearance, somewhat notched. White spot beginning about 3 mm. below the tip is oblong and purple-veined above. Wings nearly straight, linear-oblong, obtuse, rounded, with lower side a little notched, about 3 mm. longer than keel, 1 mm. wide, white beyond the keel, flat or slightly concave to it, 4-6 mm. shorter than banner. Keel about as high as long, with tip rounded and erect, about 3 mm. wide in the middle, gently arched from base, dark-purple. Calyx tube about 5 mm. long and 3 mm. wide, rather truncate below and attached on the lower corner, with pubescence short and rather appressed, with the subulate teeth rather more

than half the tube. Bracts thin as in the other species, 5-7 mm. long. Peduncles 1-2 dm. long. Leaves narrow and somewhat tapering, generally as long as peduncle or more, petioles rather shorter than the rachis. Leaflets often 20 pairs, about oval-ovate, mostly acutish, hardly contiguous, seldom 1 cm. long, with densely and mostly yellow-felted pubescence, nearly sessile. Stems from hardly any to short and spreading on the ground. Rare in southern Arizona and New Mexico, and rather common from Chihuahua and Durango Mexico and southward, mostly Tropical on dry benches and slopes, blooming in April and May. This is little more than a well-marked variety of *A. Bigelovii*.

191 *Astragalus mollissimus* Torr. Ann. Lyc. N. Y. 2 178 (1828). Pods linear-oblong, about 2 cm. long, 5 mm. wide and 3 mm. high, from a little arcuate to curved into a half circle, rugulose, inclined to be narrowed at the boss-like base, triangular-acute, with the flat beak not or rarely oblique (as in *A. Humboldtii*), about 2-celled nearly to the tip, inclined to be velvety-pubescent when young but smooth with age, not inflated. Flowers purple, about 2 cm. long, spicate. Banner about oval, 1 cm. long, arched rather abruptly at end of calyx tube to 30-45 degrees and then straight, with sides reflexed about 2 mm. wide in the middle, white spot filling the blade to within 2 mm. of the sides and purple around the upper end. Wings broadly linear, about 2 mm. wide, white at tip, a little arcuate, about 2 mm. longer than keel and often nearly as long as the banner. Keel with straight base, about 5 mm. long and then abruptly erect and 3 mm. high, very obtuse and rounded, purple-tinged or striped. Calyx tube 5-7 mm. long, 3-4 mm. wide, about as in *A. Bigelovii*, a little wider below and truncate and inserted, on the lower and fleshy corner, loosely long-shaggy, with the subulate teeth about half as long as tube. Bracts reaching the middle of calyx. Pedicels very short. Peduncles 1-3 dm. long, subscapose, stout, mostly about as long as the leaves. Leaves not conspicuously acuminate, with petioles not over half the whole. Leaflets 10-15 pairs from nearly ovate and acute to broadly elliptical and obtuse, 1-2 cm. long, variably silky-hairy with long hairs which are a little felted and generally yellowish. Stems straggling upward, with few nodes, rarely 1 dm. long, with short internodes. Crowns inclined to be woody. This differs from *A. Humboldtii* in the shaggy calyx and smooth pods and from *A. Bigelovii* in the smooth pods not inflated and in the short and narrower bracts and more acute leaflets which also are normally larger. Northern Colorado at Windsor and eastward to Nebraska and southward to Texas and westward to Flagstaff Arizona, not in the Navajo Basin. common on the Plains in gravel. Lower Temperate life zone. This is the "Loco" a stock poison, affecting the motor nerves and the vision. Being the first green thing out in the spring stock get to eating it and soon are poisoned so that they stagger and become emaciated and finally crazy, when taken away from it they appear to recover but never are reliable again. *A. lentiginosus* and *A. Pattersoni* have the same effect. It is probable that most of the species are poisonous but do not come out till there is plenty of forage. Stock will not eat it if there is anything else to eat.

192 *Astragalus giganteus* Watson Proc. Am. Acad. 17 370 (1882). Pods oval-ovate, conspicuously inflated, from a little oblique to decidedly obcompressed, about 1 cm. long, 7 mm. wide and 3-5 mm. high, strongly cross-wrinkled, slightly sulcate dorsally and with sutures very convex, truncate and strongly attached to calyx, strongly mucronate at tip with the flattish and deltoid beak several times wider than long, ventral suture deeply depressed forming a groove from base to two thirds of the way up then strongly humped and recurved to form the rather declined but nearly symmetrical beak, the pods suggest very strongly those of *A. Canadensis* var. *Carolinianus*. Flowers yellowish, inclined to be reflexed, 1.5-3 cm. long, narrow. Banner about ovate, with sides reflexed a little below, arcuate 30-45 degrees at end

of calyx tube and abruptly so. straight beyond, hardly 1 cm. long. Wings linear, about straight, about 2-3 mm. longer than keel and nearly as much shorter than banner. The keel straight to near the tip and then abruptly erect, about 3 mm. high, rounded. Calyx tube 7-8 mm. long and 3 mm. high, truncate below, inserted on the lower and fleshy corner, yellowish with loosely appressed but rather long hairs with shorter ones felted below. Pedicels rather slender, about 4 mm. long in fruit and as long as the triangular-subulate bracts. Peduncles 2-3 dm. long, shorter than the leaves. Leaves short-petioled. Leaflets rather conspicuously smaller above, of many pairs, elliptical, inclined to be diamond-shaped and acute, 2-4 cm. long, finely and rather sparsely silky-felted with appressed and tangled hairs and with some longer ones intermixed and mostly yellowish. Stems 1-3 ft. high, flexuous, rarely erect, stout, with rather few internodes much shorter than the leaves. Blooming in summer and fall, growing on moist banks and gravelly bars along streams from Fort Davis in western Texas to the White Mts. New Mexico and southward to Guerrero Mex. Pringle's No. 1218 distributed as part of the type of *A. Yapuianus* is this species.

Astragalus giganteus* var. *Yaquianus (Watson Proc. Am. Acad. 23 270 1888 as species). This differs from the species only in the calyx tube being 1.5 cm. long, the petals with exerted claws, the lanceolate and little arcuate banner about 1.5 cm. long, the narrowly-oblong wings a little longer than the keel, and keel hardly at all arcuate, obliquely oblanceolate, half cuneate, and acutish. Stems are much shorter and straggling upward, the leaves longer and less pubescent and with larger leaflets. Sierra Madre Mts. Mexico from Colonia Juarez to the Yaqui river along stream beds just on the edge of the Tropical life zone.

193 ***Astragalus Orizabae*** Seaton Proc. Am. Acad. 28 117 (1893). Pod rugose, about 1.5 cm. long, when nearly globose 1 cm. wide and high, when ovate (as in the variety) it is 2 cm. long and a little arched the ventral suture is straight and deeply sulcate but not so dorsally, beak conical and declined and 1-2 mm. long, base cordate, surface somewhat short-hairy and sparsely felted, pods distinctly inflated, in dense and short spikes, on peduncles shorter than the leaves. Flowers 2 cm. long, narrow, ochroleucous or purple-tinged, in short and dense spikes, spreading. Banner linear-oblanceolate, 1.5 cm. long, slightly ascending, with sides reflexed in the middle 2 mm. wide, narrowed at tip, fully 1 cm. longer than keel and 5 mm. longer than wings. Wings linear, straight, about 2 mm. wide, rounded. Keel with exerted claw, 5 mm. long, 2-3 mm. high, half rhomboidal, with the rounded, purple tip nearly erect, with base straight to the middle and then sharply arcuate to nearly 90 degrees. Calyx broadly cylindrical, a little narrower at tip and cleft deeper above and a little oblique at tip, inclined to be truncate and nearly equally inserted at base, with teeth subulate and rather lax and about two thirds as long as tube. Bracts triangular and about 3 mm. long. Leaves linear, 2-3 dm. long in the type, with 15-18 pairs of leaflets which are elliptical, rounded, closely felted, inclined to be a little narrower below, 1-1.5 cm. long in the type. Stems tufted, zigzag, 1-2 dm. long, rather thick and woody at base, in rocky places. Mt. Orizaba below Mexico City. Seaton. Hacienda Palmar near Pachuca, July 21 1905, Rose, Nat. Herb. No. 452293. Near Irola June 14 1899, Rose, Nat. Herb. No. 346530, the lower plant on the sheet. Barren hills near Esperanza, Puebla Aug. 17 1903, Rose, Nat. Herb. No. 450191. Near Calchicomula, Puebla, Rose, July 24 1901, Nat. Herb. No. 395437.

Astragalus Orizabae var. Irolanus N. Var. Pods ovate and shortly acuminate, 2 cm. long, 1 cm. wide, shallow-sulcate at both sutures. Leaflets sharply acute at both ends, 1.5-2 cm. long, inclined to be silky pubescent. Leaves 3-4 dm. long. Peduncles often 4 dm. long. Flowers often 2-3 cm. long. Collected near Irola Mexico by J. N. Rose, June 14 1899, Nat. Herb. No. 346530, the upper plant on the sheet. Another specimen is from near Lajos Hidalgo, Aug. 5 1905 by Rose, Nat. Herb. No. 452656.

194 Astragalus anisus Jones Cont. 4 34 (1893). Pods about 1.5 cm. long, oval, completely 2-celled by a thin partition, chartaceous, rather spongy and thinly fleshy when green, finely reticulated, a little sulcate at both sutures, hardly oblique, few. Flowers spreading, 6-10, subcapitate, but short-spicate in fruit. Calyx tube 1 cm. long, with the subulate teeth about 2 mm. long. Bracts and pedicels about equal and 4 mm. long. Peduncles shorter than the leaves, about 2.5 cm. long, stout and erect. Leaves about 5 cm. long, with petioles fully as long as the rachis. Leaflets 3-6 pairs, obovate to oval, rounded, 4-7 mm. long, contiguous. Stems very short, with internodes hardly as long as the lanceolate stipules. Whole plant silvery with rather long and echinate and slender hairs fixed by the middle, the calyx only nigrescent. A unique species only a few inches high, never found but once, and then only in fruit, near Pueblo Colorado, Lower Temperate life zone.

195 Astragalus orthanthus Gray Proc. Am. Acad. 6 195 (1864). Pods about 3.5 cm. long, few on the short rachis, inclined to be sulcate at both sutures, finely reticulated and cross-ribbed, completely 2-celled. Flowers red, about 3 cm. long, loosely short-spicate, very narrow and with elongated and exerted claws. Banner lanceolate and hardly arcuate. Wings linear, hardly as long as the oblanceolate keel whose tip is only slightly arcuate and acutish much after the style of *A. coccineus* and *giganteus*. Calyx tube about 1 cm long, 3 mm. wide and a little narrowed above, the base obliquely triangular and fleshy and rather unequally inserted, the subulate teeth about 3-4 mm. long. Bracts and pedicels about equal and 3 mm. long. Peduncles shorter than the leaves, 1-2 dm. long. Leaves narrow, almost sessile, with 12-15 pairs of narrowly elliptical and acutish but not contiguous leaflets which are nearly 2 cm. long and velvety-hairy to nearly smooth, with appressed hairs fixed by the base. Stems 1-4 dm. long, ascending, internodes rarely 5 cm. long. Stipules rather large, triangular. Near Saltillo and in Coahuila Mexico, in rocky places, blooming in summer, lower part of the Lower Temperate life zone.

SARCOCARPI. 22.

Pods wholly 2-celled, very fleshy, with thick walls which never become less than coriaceous when dry, opening but little at maturity, mostly plum-like, lanceolate in *A. Tennesseeensis*, oblate to round in cross-section, cordate or notched at base, rarely at all inflated, not stipitate, splitting the calyx, mostly sulcate at both sutures, 1.5-2.5 cm. long, weakly attached to the calyx, with ventral suture straight, rarely convex, or concave, the dorsal the more arched. Flowers in heads or short spikes, never small nor reflexed, on peduncles shorter than the upper leaves, and on pedicels shorter than the large bracts, 1.5-2 cm. long, light-colored. Calyx cylindrical, 6-8 mm. long, obliquely attached by the fleshy base, straight, hairy, with teeth much shorter than the tube. Leaves larger above, the lowest ones quite small, narrow, with many leaflets which are never linear but are nearly contiguous, mostly flat, jointed to rachis and petiolulate. Stipules large and broad, hyaline and thin, adnate, not reflexed, not connate. The bracts lanceolate and acuminate. Stems prostrate to ascending, slender or with short internodes, never acaulescent though the internodes are often shorter than the stipules, from a thick and often woody root, in tufts. Pubescence attached by the base. Growing in sweet soil, never in saline places. This group is the nearest related to the *Argophylli* and *Malaci*. It is possible that *A. Parryi* may belong here, it has a superficial resemblance to *A. Tennesseeensis*. but the pods are thin and nearly 1-celled, and the flowers and general habit are different.

KEY

A. Pods smooth, very fleshy, plum-shaped, very abruptly short-beaked, edible, with the fleshy walls 4-6 mm. thick, reflexed or widely spreading, lying flat on the ground, with the cavity somewhat larger than the seeds, sutures raised and thick when dry. Stems 1-2 ft. high.

Calyx very short-hairy, flowers not ochroleucous.

196 *crassicarpus*.

Calyx woolly, flowers ochroleucous.

197 *Mexicanus*.

2A. Pods decidedly pubescent, ovate to lanceolate, rather obliquely acuminate or with a long and stout beak, somewhat fleshy but walls rarely 2 mm. thick, sutures not evident externally. Flowers white.

Pods short-pubescent, about ovate, finely cross-lined, abruptly stout-beaked.

198 *Plattensis*.

Pods sparsely long-pubescent, acuminate-lanceolate, coarsely reticulated.

196 *Tennesseeensis*.

196 *Astragalus crassicarpus* Nutt. in Fraser's Cat. 1 (1814). Pods nearly globose, a little obcompressed when fresh and appearing laterally flattened in most herbarium specimens and greatly and coarsely wrinkled for the most part, about 2.5 cm. long and 1.5 cm. wide, sulcate at both sutures when fresh and appearing laterally flattened

in most herbarium specimens, but still globose when maturing naturally, herbarium material is greatly and coarsely wrinkled mostly, about 2.5 cm. long and 1.5 cm. wide, sulcate at both sutures when fresh and very shortly mucronate-beaked, green to reddish. Flowers normally bluish-purple but often nearly white, with elongated banner and wings, rather loosely racemose-spicate, about horizontal. Banner ovate to oblong-ovate, nearly 1.5 cm. long, deeply notched, with sides very much reflexed so that it seems almost linear, abruptly arched at end of calyx tube to 45° . Wings elongated, about 1 cm. long and 3 mm. wide, slightly ascending, very oblique at the notched tip, narrower above, mostly white, much longer than keel. Keel straight, about 5 mm. long, the tip abruptly arched to erect and 3 mm. high, very broad, the corner about square, purple. Calyx blackish with rather sparse and very short and closely appressed hairs, the teeth very variable but mostly 2-4 mm. long and triangular. Bracts twice the rather long pedicels in flower and about as long in fruit. Peduncles from much shorter than, to as long as the leaves. Spikes 5-10 cm. long and rather close. Leaves 1-1.5 dm. long when fully developed above, the lower ones much reduced, ashy to smooth. Leaflets 8-12 pairs, narrowly to broadly elliptical, the lowest often oval, 1-1.5 cm. long. Stipules ovate. Stems about a foot long, weak and widely spreading. Pubescence ashy to almost none, especially on the stems and pods, of short and flat appressed hairs. Common on sweet soil on the prairies from northern Texas to the base of the Rockies and northward to the Saskatchewan, not on the Snake river drainage, but on the Laramie Plains, and on the Pacific slope along the tablelands of the head waters of the Missoula in Deer Lodge Valley, eastward to eastern Iowa and Minnesota, Middle Temperate life zone, and descending a little into the Lower Temperate at the south. In early days the fruit was eaten by voyagers and called Pomme du Prairie. When the fruit matures naturally it becomes very cellular between the inner and outer skins and very light and is easily blown about by the winds. It does not open at maturity but gradually falls apart by decay. Its cellular character is like that of *A. pygmæus* and *Musiniensis* of the Navajo Basin.

Astragalus crassicarpus* var. *pachycarpus, (T. & G.) Jones Cont. 8 17 (1898). *A. pachycarpus* T. & G. Fl. 1 332 (1838). This is a southern form with pods round to oblong or ovate, decidedly obcompressed. Flowers narrower and slender, whitish, about 1.5 cm. long. Calyx smooth or nearly so. Bracts subulate and smaller. Pedicels slender. Peduncles much shorter than the leaves. Leaves very narrow. Leaflets 11-16 pairs, rather long-petiolulate often oblanceolate, about 1 cm. long. Stipules rather short and narrow. Stems slender, 1-2 ft. long. Nearly smooth throughout. This is the form mostly of Missouri to Texas. The pods vary greatly from decidedly oblique with the mucro above the middle to plum-shaped.

197. *Astragalus Mexicanus* A. DC. Pl. Rar. Gen. 4 16 t 3 (1826). *A. trichocalyx* Nutt. Geoprimum Rydberg. Pods about as in *A. crassicarpus*. Flowers cream-white. Calyx white and woolly with long hairs, almost sessile and with long bracts, teeth very short. Banner about 1 cm. long, ovate, with sides reflexed below and seemingly triangular. Wings almost straight, a little longer than the keel, oblique. Keel as in *A. crassicarpus*. Flowers very short-spicate, the clusters rarely 5 cm. long. Leaves as in *A. crassicarpus* but nearly smooth. Peduncles often as long as the leaves, not short. Plants 1-2 ft. high, rather stout. Missouri to Texas and southern Nebraska, on prairies eastward to Illinois. Lower Temperate life zone.

198. *Astragalus Plattensis* Nutt. in T. & G. Fl. 1 132 (1838). Geoprimum Rydberg. Pods about 1.5 cm. long, oval ovate, 6-8 mm. wide, and about 4 mm. high, conspicuously obcompressed and sulcate ventrally, straight but decidedly oblique by the ventral suture

being about straight and the dorsal very convex, the conical and stout beak about 4 mm. long and a prolongation of the ventral suture and in line with it, evidently inflated a little, walls thinner than in any of the allied species, coriaceous, less than 1 mm. thick when fresh and very thin when dry but rigid and a little corrugated, base cordate. Surface covered with very many fine and parallel cross lines close together. Flowers white, in a head, several, about 1.5 cm. long. Banner ovate, with sides reflexed to the tip and seeming triangular, notched a little, arched gently to 45-90° from end of calyx tube, about 2-4 mm. longer than keel. Wings nearly linear, a little arched, about 2 mm. wide, rounded at tip and about 1-2 mm. longer than keel. Keel with tip arched in a quarter circle to the very obtuse and rounded tip, the base straight, purple tipped, 3 mm. high. Calyx tube oblong, 5 mm. long, nigrescent, the triangular teeth about half as long as tube. Bracts about twice the pedicels which are short in flower and about 4 mm. long in fruit. Peduncles about half as long as leaves. Leaves about 1 dm. long, with very short petiole, of 8-14 pairs of elliptical to oblong-obovate leaflets 5-8 mm. long. Stems slender, weakly ascending to prostrate, rarely 2 dm. long. Stipules about as long as the adjoining leaflets. Pubescence shaggy all over except on the more sparsely hairy calyx. On the plains from Texas to western Nebraska and Wild Co., Colorado, and eastward to Indiana and Alabama. Lower Temperate life zone.

199. *Astragalus Tennesseensis* Gray in Chapman's Fl. 98 (1860). *A. Plattensis* var. *Tennesseensis* Gray. Pods lanceolate to oblong, acuminate, a little arcuate, the tip forming a flat or round upcurved prow, inclined to be obcompressed and sulcate at both sutures, very fleshy, but when dry forming a soft and spongy papery tissue about 2 mm. thick, much wrinkled, 2-3 cm. long, 7-8 mm. wide, 3-4 mm. high, nearly round in cross section, very sparsely long-hairy, neither suture raised, base usually obtuse to notched. Surface of pod very coarsely corrugated with raised lines and large meshes. Flowers 1.5-2 cm. long, white. Banner gently arched to 45°, ovate, sides reflexed most below, 7-8 mm. long. Wings narrowly oblong, a little arched, narrowed toward tip, 2-3 mm. wide, 2 mm. longer than keel. Keel straight, about 5 mm. long, tip abruptly arched to erect and very obtuse, about 3 mm. high. Calyx about 3 mm. high, the triangular teeth not 2 mm. long. Bracts ovate, 5-7 mm. long. Pedicels very short. Peduncles shorter than the leaves, except the lower ones. Leaves about 1 dm. long. Leaflets elliptical, 12-15 pairs, long-petiolulate, separated by about their own width. Stipules very large, 1-1.5 cm. long. Pubescence long and softly villous except on the upper sides of the leaflets and the stipules. Lower Temperate life zone from southeastern Iowa to Tennessee and Alabama and Missouri. This connects the *Sarcocarpi* with the *Argophylli* and *Malaci* through *A. Parryi*.

OCREATI. 23.

Perennials with densely tufted short stems with congested internodes or the upper ones elongated but much shorter than the leaves, branched below, ascending to erect, from a woody root, rarely 3 dm. long. Stipules sheathing but rather small. Leaves narrow, all petioled, 1-3 dm. long, the rachis at least as long as petiole and slender. Leaflets 5-8 pairs, narrow to oblong, mostly acute and folded, not acicular, not contiguous. 2-3 cm. long. long-petiolulate and jointed to petiole. Flowers spicate or in fruit a little racemose, about sessile, 6-12 mm. long, neither reflexed nor stubby, with cylindrical to long-campanulate tube which is 3-5 mm. long and mostly a trifle longer than the subulate teeth. Bracts elongated and conspicuous, triangular-subulate. Pods conspicuously obcompressed, inclined to be sulcate above and below, oval to oblong, abruptly apiculate, not much exerted from the calyx, coriaceous and variously corrugated, the sides rounded, cross section variously reniform or like the figure 8 but not at all 2-celled nor with sutures produced within, mostly a little oblique at tip but not arched, very slightly if at all inflated. Ventral suture raised externally and very much thickened or prominent, pod when sulcate ventrally is so on each side of suture. Plants of the arid deserts mostly in alkaline and very poor clay soil, but not in sinks or where water stands. Pubescent with closely appressed hairs. Plants blooming in early summer.

KEY.

- A. Pubescence attached by the middle or near it (by the base in *A. argillosus*), of flat and tapering hairs. Stems densely tufted and decumbent, slender, at least 1 dm. long when fully developed, hoary. Leaflets linear, about 2.5 cm. long. Flowers densely spicate, about 1 cm. long. Bracts about as long as calyx and its lobes. Pods splitting the calyx at maturity, shallow-sulcate at both sutures.
- AB. Pods hoary, about equaling the calyx teeth, ovate to oval, straight but tip rarely a little curved, rounded at base, mostly acute, obcompressed at least at base and mostly sulcate, with ventral suture prominent, loosely spicate. Flowers white to yellowish, about 12 mm. long. Calyx short, campanulate; teeth subulate, about as long as tube. Leaves 1-1.3 dm. long. Leaflets 2-5 mm. wide, 2.5 cm. long, 4-7 pairs. Stipules hyaline, broad, about 7 mm. long. Stems flexuous, some internodes 8 cm. long, perennials. Whole plant erect or ascending 1.5-3 dm. long. Pubescence closely appressed throughout, hoary except the pods rarely. Plants with a strong snake-like odor.

Peduncles very short or none.

200 *sophoroides*.

Peduncles at least as long as leaves.

201 *confertiflorus*.

A2B. Calyx tube conspicuously long-hairy and shaggy; teeth and bracts very long. Flowers purple. Blooming in May.

Whole plant appressed-silvery-silky.

202 argillosus.

2A. Pubescence attached by the base. Peduncles long, with small flowers in narrow spikes which become racemose in fruit. Pods not splitting the calyx. Stipules small and united only below. Bracts 2-5 mm. long. Stems slender or almost none, nearly erect, flexuous, with very short internodes below. This grows on limestone cliffs and in sandy washes.

Sutures not thick. Peduncles filiform and rush-like. 203 Moencoppensis.

Sutures thick. Peduncles not elongated.

204 troglodytes.

200. *Astragalus sophoroides* Jones Zoe 2 12 (1891). Pods with ventral suture little raised, not very conspicuously thickened, arched, 5-9 mm. long, not 2 mm. thick, greatly obcompressed, elliptical, barely acute, chartaceous, flattened but not sulcate at base; seeds several, large. Flowers not over 9 mm. long, white to cream-colored, purple-tinged, short, erect. Calyx inclined to be shaggy. Bracts ovate to lanceolate, acuminate, about as long as calyx tube, 5-7 mm. long, scarious. Peduncles none to 1 cm. long, and spikes 2.5-7.5 cm. long, flower-cluster mostly sessile among the leaves and shorter than the leaves, earliest peduncles 7-15 mm. long, and spikes 2.5-5 cm. long and so appearing sessile among the leaves, but later peduncles often 1 cm. long and the spikes 7.5 cm. long, latest peduncles equal the earliest. Leaves 7.5-9 cm. long. Petioles 2.5-4 cm. long. Leaflets 4-7 pairs, oblong linear to nearly oblong, rounded at end and cuneate at base, 2-9 mm. wide, 1-3 cm. long. Stipules connate even to the top of the stems, upper part acuminate-triangular. Stems rather slender, 8-30 cm. long, internodes several and 2.5-6 cm. long. Pubescence of stems very dense and a little spreading, on calyx rather coarse and entangled, on pods the same but shorter, oldest stems and leaves are sometimes only pubescent. On the Moencoppa, northern Arizona, Lower Temperate life zone on benches.

201. *Astragalus confertiflorus* Gray Proc. Am. Acad. 13 368 (1878). *A. flavus* var. *candicans* Gray. *Cnemidophacos* Rydberg. Leaflets 4-6 pairs, 1.5-2.5 cm. long, linear, 2 mm. wide. Spikes dense and many flowered, 5-7 cm. long on peduncles 7-9 cm. long. Flowers white, becoming cream-colored with age. Banner arched in gentle arc from base to tip to 45-80°; groove is V-shaped opposite keel tip but flattens out very greatly above where it is 3 mm. wide and 1 mm. deep; sides reflexed to 1 mm. wide opposite the keel, not at all at tip and so making it seem obovate-oblong to fiddle shaped (in the dried plant seeming lanceolate) and elongated, emarginate. Wings obliquely lance-oblong, 1 mm. wide, the tip bent up to 45° and notched below the middle, 2-4 mm. longer than keel and concave to it, the right hand one bent over keel tip and the other bent out but with its tip turned in and touching the other, concealing the keel. Keel very short relatively, exceeding the calyx tips 2-4 mm., the tip abruptly incurved to over 90° and very blunt and rounded, with a purple eye at tip which is surrounded by a narrow white edge. Calyx nearly round in cross section, about 4 mm. long, the lower edge straight and the upper a little arched, base with a fleshy green spot and oblique, almost sessile, cleft deeper above and with rounded sinuses, the teeth spreading, green and 2-3 mm. long. Pods bisulcate at the thick ventral suture, is trifle concave, or even convex, about 7.5 mm. long, oblong-oval, silky to smooth, moderately obcompressed mostly but not sulcate dorsally. The flowers are often purple tinged and then the white spot is waterlined with purple. The pubescence of the calyx is looser and finer, the calyx teeth and bracts are more filiform,

and the flowers much elongated and often nearly yellow. This is the common form throughout the Navajo Basin far up on the Little Colorado eastward into its New Mexican and Colorado borders and down the Colorado to the edge of Nevada and up the Virgin in Utah. Lower Temperate life zone and dropping down a little into the Tropical. Also along the Sevier river near Richfield and Salina, Utah.

Astragalus confertiflorus var. flaviflorus (Kuntze). *Tragacantha flaviflora* Kuntze Rev. Gen. 2 941 (1892). *A. flavus* Nuttall, *Cnemidophacos* Rydberg. This has the leaves of the species but inclined to have narrowly oblong and flat leaflets, the lowest very short and broad. Upper leaves much the best developed. Pods 7-12 mm. long, generally twice the calyx, ovate to oblong oval, variably pubescent with curved hairs, about straight, retuse at base, minutely stipitate, broadly and rather deeply sulcate dorsally and the sutures nearly touching. Flowers 12-15 mm. long, in the type cream colored and with rather short and mostly ovate banner, but variable. Wings linear, narrower than keel, a little arched, 2-3 mm. longer than keel. Keel a little arched along the claw, the blade abruptly incurved at the end to erect and very obtuse, the upper corner being about square or very rounded and not at all produced, the general outline being oblanceolate, straight. Calyx short-cylindric, the tube nearly 5 mm. long. Peduncles 1.5-3 dm. long, strict, stout and sulcate, appearing as if subscapiform. Spikes loose, 1-1.5 dm. long, 10-15-flowered. Leaflets broadly linear to narrowly elliptical, rather acute, nearly smooth above. Stems short and with short internodes, diffusely branched and decumbent, 1.5-2 dm. long. Deserts of southern Wyoming, Lower Temperate life zone.

202. Astragalus argillosus Jones Zoe 2 241 (1891). Pods scarcely surpassing the calyx lobes, erect, ovate to oval, blunt, hoary with long and appressed hairs, about 7 mm. long, much obcompressed till cross section is nearly linear, a little arched, with dorsal suture deeply impressed toward the base and raised and prominent at tip and conspicuously thickened; the ventral suture inconspicuous. Flowers short, about 9 mm. long, densely spicate even in fruit, almost sessile, pink-purple. Banner oval, abruptly arched below calyx tips to 45°, purple and with white spot strongly veined, 5 mm. longer than keel and 2 mm. longer than wings. Wings narrowly-oblong, a little arched, rounded, purple, dark-veined toward the tip, narrower than the keel. Keel short, about as long as calyx tips, straight, with tip abruptly erect and deltoid. Calyx tube short-campanulate, not 5 mm. long, white with very long and appressed hairs which toward the tip and on the lobes are widely spreading and shaggy. Hairs flat, twisted, with pustulate base, attached by the end. Calyx lobes subulate from a broad base, 9 mm. long, lax, green, longer than the tube. Bracts large, 9 mm. long, green, linear-subulate, about equaling the calyx. Spikes very dense, 2.5-7 cm. long. Peduncles 5-15 cm. long, slender, subscapiform, as long as leaves. Stipules connate nearly to tip, green (hyaline below) long-acuminate, densely appressed-villous as well as stems. Petioles grooved. Leaves 5-10 cm. long, narrow. Leaflets narrowly linear to oblong, 2.5-3 cm. long, 2-5 mm. wide, silvery, 4-6 pairs, acute to apiculate, greener than the rest of the plant. Stems caespitose, ascending, rather stout for the plant, short, flexuous, 2.5-20 cm. long, biennial or short-lived perennial, whole plant 1.5-3 dm. high, appressed-silvery-silky even to the stipules. On sandy clay soil along the Green river and San Rafael Swell, Utah, and vicinity. Lower Temperate life zone.

203. Astragalus Moencoppensis Jones Zoe 2 12 (1891). Pods 5-7 mm. long, 3 mm. wide, with cross-section nearly transversely linear, with sutures not thick nor prominent, hoary, about as long as calyx and teeth, acute, oblong-oval, barely sulcate dorsally,

slightly so ventrally. Flowers spreading, deep-bluish-purple-tipped, about 7 mm. long and 2-5 mm. long, longer than the calyx and teeth. Banner broadly ovate, veined, with sides reflexed much and arched at the end of calyx tube to 45° , 5-7 mm. long, with short claws, 2 mm. longer than keel. Keel straight, broad, truncate, with tip erect. Wings 2 mm. shorter than banner, broadly oblanceolate, little arched, narrower than keel, rounded, oblique. Calyx tube 3 mm. long, shaggy above with tangled and very fine hairs, the subulate teeth a little shorter than the tube. Bracts 2-5 mm. long, hyaline, ovate to lanceolate. Peduncles (as well as stems and leaf rachis) filiform and rush-like, often a foot long, tapering, racemose on the upper half. Leaves often 3 dm. long, mostly 7-9 cm. long. Petioles generally grooved, green, a quarter to as long as the leaf. Leaflets nearly smooth, broadly linear to almost filiform, about 2.5 cm. long, the upper ones reduced or abortive, about 5 pairs, acute, all distant, somewhat narrowed below. Lower stipules broadly triangular, short, hoary above. Internodes very slender, 1-3, the upper 5 cm. long. Whole plant nearly smooth except the calyx and pods. Stems densely tufted from a long and erect tap root. On the Moencoppa in the Little Colorado region of northern Arizona in the Navajo Basin and in the San Rafael Swell south of Green River, Utah, in sandy places. Lower Temperate life zone.

204. *Astragalus troglodytes* Watson Proc. Am. Acad. 20 362 (1885). Leaflets 6-8 pairs, oval to obovate and obtuse or rarely acute, about 1 cm. long, with closely appressed hairs fixed by the base. Leaves erect, about 1 dm. long, with petiole inclined to be longer than its rachis. Stems almost none. Peduncles ascending to erect, about 1.5 dm. long. Flowers spicate, rather many. Bracts recurved, linear-lanceolate-acuminate, about 1 cm. long. Calyx about 4 mm. long, with teeth about half as long. Flowers about 1 cm. long. Pods loosely hairy, 5-7 mm. long, conspicuously obcompressed, and cross-section oblately oblong, with the thick sutures of *Gilensis* and its abrupt apiculation, the suture only slightly arched at tip and base, not sulcate, cavity inflated. The pods have about the shape of *Matthewsii* on a minute scale, only a little exceeding the calyx, but it has no relation to the *Scytocarpi*. It is manifestly a close ally to the *Sericoleuci*, *Gilensis* section. Coconino in the San Francisco Mts., Arizona. Lower Temperate life zone.

BISULCATI. 24.

Pods wholly 1-celled, pendent on a slender stipe which exceeds the calyx except in *A. oocalycis*, oval to linear, 7-25 mm. long, 5-7 mm. wide, triangular-pointed to apiculate, completely obcompressed ventrally, and dorsally often flat, nearly smooth to conspicuously and parallel-cross-veined, chartaceous, opening along the ventral suture if at all, not explanate, cross section that of a vertical half-section of the figure 8 by having the ventral side bisulcate, the grooves being on each side of the conspicuously raised and thickened suture (when young the pods are normally greatly laterally compressed and not sulcate), ventral suture often convex, rigid, with a thin edge, dorsal suture not evident. Flowers 7-15 mm. long, narrow (broad in *oocalycis*), with slightly exerted claws, horizontal, reflexed in fruit, densely spicate, becoming looser in fruit, many, the keel conspicuously elongated and mostly as long as the banner. Banner nearly ovate, 5-7 mm. long, with sides greatly reflexed and so seemingly narrow, deeply notched, rather abruptly arched beyond calyx tips and keel to at least 45°, veined below. Wings obliquely oblanceolate, narrow, obtuse, much arched and exposing base of keel, not over 2 mm. wide, barely surpassing keel. Keel blade lunate in general outline, about 7 mm. long, the base straight and then gently arched to the nearly erect and rounded purple-spotted tip, about 3 mm. wide. Calyx inclined to be inflated, very thin and hyaline, normally white, rarely red, saccate at base on the upper side, 2-5 mm. long, cylindric-campanulate, oblique at tip and base, a little laterally flattened, not contracted at either end, inserted on the lower corner, teeth subulate from a deltoid base, not as long as tube, unequal. Pedicels inserted on lower corner of calyx and often at right angles to it, filiform (almost none in *A. oocalycis*), ascending, in fruit often 5 mm. long. Bracts conspicuous, very thin, with very narrow or thread-like tips, as long as pedicels, 5-7 mm. long. Peduncles proper generally as long as leaves, and with the rachis in fruit 1-5 dm. long, strict and erect, sulcate as well as the stems and petioles. Stipules rather large above, hyaline, triangular, green-tipped, spreading or reflexed, not connate. Upper leaves with short petioles or none, 5-10 cm. long and the largest, the lowest leaves very small and long-petioled. Leaflets about 10 (8-15) pairs, petiolulate, and jointed to rachis, flat, obtuse, about smooth, 1-2.5 cm. long, rather broadly linear to elliptical. Stems slender, tufted and erect,

rarely decumbent at base, 2-3 ft. high, perennial from woody roots. Odor snake-like. Pubescence attached by base, echinate, very short, abruptly appressed.

KEY.

A. Pods on a stipe at least as long as calyx and pendent. Calyx tube about 3-4 mm. long, little inflated, both sides about straight. Flowers not stubby. Leaflets not linear.

Pods oblong or oval. Flowers white, in long and loose spikes.

205 *Haydenianus*.

Pods linear. Flowers normally purple, in short and dense spikes.

206 *bisulcatus*.

2A. Pods short-stipitate and wholly inclosed within a large and bladderly calyx. Leaflets linear. Flowers stubby the blades not longer than calyx tube.

Calyx shaggy and inflated.

207 *oocalycis*.

205. *Astragalus Haydenianus* Gray in Brandegees's Rep. 235 (1876). Pods mostly oval, rarely oblong, rugulosely cross-nerved, often papery, 7-9 mm. long by nearly 4 mm. wide, very variable in texture, rounded at both ends, obtuse, minutely nigrescent but seemingly smooth, 6-7-ovuled, 2-4-seeded, with ventral grooves broad and ventral face widely and deeply impressed, the suture being rib-like and very prominent and often convex. Stipe not longer than the calyx. Flowers white, about 7-9 mm. long. Wings appearing as if shorter than the purple-tipped keel. Mature banner reflexed till the tip nearly touches the calyx, about 9 mm. long. Calyx white and thin, the teeth much shorter than the tube. Spikes in fruit linear and often 3 dm. long and fully twice as long as peduncle but the peduncles sometimes a foot long. Stems slender and weakly ascending, many. Pubescence of barely flattened hairs. Occasional from Palisade, Nevada, to along the Virgin river, Utah, above St. George and along the north side of the Grand Canon and throughout the Navajo Basin, also in southern Wyoming, and along the Rio Grande in New Mexico. Lower Temperate life zone, in rather alkaline places on bottoms, nearly wholly on the Pacific slope.

Forms of this species which have been described as species or varieties but which do not deserve even varietal rank are as follows: *A. Haydenianus* var. *Nevadensis* Jones, which is *A. demissus* Greene and *A. Jepsoni* Greene, has the pods not evidently rugulose, about 5-seeded, papery, barely acute at each end, elliptical, 9 mm. long, 5 mm. wide, or smaller. Proper peduncles barely as long as the leaves. Spikes very long and slender, often 2 dm. long. Leaflets 8-10 pairs, thin, obovate to ovate-oblong, very obtuse or retuse. Bracts broadly lanceolate, barely acute. In the forms described by Greene cited above from the same locality the leaflets are linear-oblong and 2 cm. long.

A. grallator Watson is an abnormal form with distinct stipules acuminate-deltoid, immature pods 7 mm. long, ascending, thin-coriaceous, nearly glabrous, about as long as calyx, transversely rugose, at first laterally compressed, later becoming obcompressed and turgid. Leaflets narrowly oblong, about 10 pairs, 1-2 cm. long. Peduncles longer than the leaves. Pedicels filiform, 7-9 mm. long. Flowers 7 mm. long, pale-rose to white. Steamboat Springs, Colorado. Var. *major* Jones. This is a stouter form approaching *A. bisulcatus*. Pods spreading, seldom pendent, narrowly-elliptical-oblong, rugulose-veined, straight to curved, 1 cm. long by 3 mm. wide, shortly acute at both ends, dorsal suture a little sulcate. Flowers 1 cm. long, narrow. Banner ascending. Claws of wings exerted. Pedi-

cels villous. Bracts narrowly lanceolate, acuminate, longer than the pedicels. Calyx lobes equal the tube. Leaflets 7-9 pairs, narrowly elliptical to linear-lanceolate, very obtuse, apiculate. Sink Valley, Utah. *A. scobinatus* Sheldon was partly founded on this and on *A. racemosus* and *bisulcatus*.

206. *Astragalus bisulcatus* (Hook) Gray Pac. R. R. Rep. 12 42 t I B (1860). *Phaca bisulcata* Hooker Fl. Bor. Am. 1 145 (1834), *Diholcus* Rydberg, *Astragalus bisulcatus* var. *decalvans* Gandoger. Pods linear to narrowly elliptical, triangular-acute at tip and base, 1-2 cm. long, rather shining, with cross-nerves almost none, often involute ventrally with sides touching the ventral suture and so the pod seems cylindrical, chartaceous, usually glabrous. Flowers variable but mostly purple, rarely white, about 1 cm. long, not very narrow, nodding, in dense short (2.5-5 cm. long) spikes. Banner arched to 45-90°, 2 mm. longer than keel. Wings 1 mm. longer than keel. Keel nearly straight. Calyx 3-5 mm. long, campanulate-cylindric. Teeth variable, often setaceous, 2-3 mm. long, about as long as tube. Bracts 4 mm. long, ovate-acuminate, hyaline, setaceous often. Pedicels 2-4 mm. long. Spikes closely flowered and 7.5-15 cm. long in fruit, shorter than the peduncles, and these longer than the leaves. Leaves thickish, nearly sessile. Leaflets 8-13 pairs, elliptical to narrowly lanceolate, somewhat petiolulate, clothed beneath with minute hairs. Stipules ovate lanceolate, hyaline, acute, upper ones large and conspicuous, connate only below. Stems erect, 4-7 mm. thick, rather stout. Plants minutely pubescent even to the pods. Common on the alkaline plains from northern New Mexico to the Saskatchewan, not on the Pacific slope except at the north and then occurring only on the heads of the rivers. Middle Temperate life zone. The var. *decalvans* Gandoger is only a white flowered form.

207. *Astragalus oocalycis* Jones Cont. 8 10 (1898). *A. urceolatus* Greene. Pods like those of *A. Haydenianus* but very shortly stipitate to long-stipitate, obcompressed, oval, 7 mm. long, 3 mm. wide, nearly flat, finely cross-nerved, smooth, immature pods laterally flattened. Flowers nearly sessile, densely spicate, somewhat reflexed, yellowish-white; petals 7 mm. longer than calyx, the blades hardly half as long as calyx tube. Banner oval, thick at base, arched to 45-90° in a gentle curve, the erect part a little over 2 mm. long, very stubby, with sides reflexed above. Wings oblanceolate, nearly straight, nearly as long as banner, about 2 mm. longer than keel. Keel obtuse, short, forming about a half-circle, 3-4 mm. long, 2 mm. wide, purple-tipped. Calyx greatly inflated, 9 mm. long, 7 mm. wide, hyaline, shaggy-villous with white hairs, with straight base and upper side arched near the base; teeth triangular, 2 mm. long. Pedicels almost none. Bracts 7-9 mm. long. Peduncles 9 cm. long, stout, with dense spikes 5 cm. long. Leaves ascending, about 1 dm. long, with leaf rachis tapering, sulcate and not over 8 cm. long, the petiole about 2.5 cm. long. Leaflets thick, 8 pairs, opposite, linear, acute at both ends, long-petiolulate, puberulent below, smooth above, 3 cm. long, 7-10 mm. apart, 1-3 mm. wide. Stipules hyaline, deltoid-triangular, adnate, 5-7 mm. long. Stems erect, flexuous, 2 feet high. Internodes about 3-4 cm. long. Pubescence ashy, with hairs attached by base but tapering below and with a little knob as if a rudiment of a branch of a hair attached near the middle. On bottom lands at Aztec, New Mexico, and Arboles, Colorado, Wootton and Baker. Lower Temperate life zone. This is probably not a good species, has the appearance of a sport and the general look of *A. racemosus*, as if caused by some insect injury, but Baker's specimens from Arboles seem perfectly normal and in good fruit, the calyx is much the same as in *A. Lehmanni* of Asia. The leaves, peduncles and stems are about equally green. The pod is from almost sessile to long stipitate.

GALEGIFORMES. 25.

Pods chartaceous to coriaceous, not fleshy, nearly to fully linear, 2.5-5 cm. long, 3-7 mm. high, opening first at tip, mostly slightly inflated, mostly slender-stipitate, not jointed to stipe, reflexed, triangular-acute at both ends, smooth, triquetrous to reniform in cross section, ventral suture raised and thickened. Flowers reflexed, in dense racemes, 1.5-3.5 cm. long, white (drying to yellowish) but often tinged with purple, narrow. Banner elongated and much longer than the wings, with sides much reflexed. Wings elongated, narrowly oblong, at least 2 mm. longer than keel. Keel obliquely and broadly oblanceolate, about 7 mm. long, rounded in a gentle arc to tip which is erect and obtuse. Calyx hyaline, inclined to be colored like the flowers, variously hairy but not shaggy, cylindric, about 5 mm. long and 3 mm. high, little oblique at tip, sometimes a little narrower below, abruptly rounded at base to the lower corner where it is attached to pedicel and nearly at a right angle to it. Pedicels rather slender. Bracts triangular-subulate, mostly longer than pedicels. Peduncles stout, strict, 5-30 cm. long. Upper leaves nearly sessile. Leaflets 5-20 pairs, rather long-petiolulate, cuneate at base, mostly flat, rather thick, obtuse to barely acute, 1-3 cm. long. Stems rather many and tufted from an erect root, ascending to erect, 1-3 ft. high. Internodes inclined to be much shorter than leaves. Stems 2-7 mm. thick. Pubescence attached by base, mostly scanty, upper side of leaflets normally smooth.

KEY.

- A.** Pods wholly 1-celled, straight or nearly so, ventral suture about straight to tip. Leaflets 1.5-3 cm. long.
- | | |
|-----------------------|-----------------|
| Pods not 2-celled. | 208 racemosus. |
| Pods nearly 2-celled. | 209 scopulorum. |
- 2A.** Pods incompletely 2-celled by the dorsal suture being produced toward the ventral variously, nearly straight and when about straight then the ventral suture is the more arched, acuminate at base, abruptly acute at the declined tip which is about in a line with the dorsal suture, a little oblique at least at tip, linear to narrowly elliptical-oblong, deeply sulcate dorsally and with narrow sulcus, with sides convex or rarely flat when mature, smooth. Stipe as long as calyx tube. Calyx oblique at mouth. Flower 2-2.5 cm. long, white (yellowish when dry). Banner fiddle-shaped with sides much reflexed. Bracts scarious, subulate, about 2 mm. long, as long as or longer than the pedicels in flower. Pedicels 2-4 mm. long, curved. Calyx teeth subulate and about 2 mm. long. Peduncles fully as long as the leaves or more, strict, and (like the stems) grooved.

Leaf rachis conspicuously tapering. Leaflets oval to narrowly elliptical, 8-15 pairs, rather thin, 10-15 mm. long, about contiguous, rounded and obtuse. Upper leaves nearly all sessile, 7-10 cm. long. Stipules long-acuminate.

Pubescence shaggy.

210 Drummondii.

208. *Astragalus racemosus* Pursh Fl. 740 (1814). *A. galegioides* Nutt. Tium Rydberg. Pods 2-3 cm. long, about 5 mm. high, and 4 mm. wide, opening first at base and along the ventral suture, shining, very faintly reticulated, abruptly acute at tip and rather tapering at base, young pods decidedly more arched ventrally, but the suture sometimes a little concave with age and the tip nearly in line with it, cross section triquetrous with concave sides to oblately deltoid, dorsal suture not evident externally but raised as a thin edge within, ventral suture sharp and narrow. Stipe not longer than calyx, about 2 mm. long, bent near the middle and with a knob but not jointed. Flowers very many in dense spike-like racemes, purple-tipped to white, with snake-like odor, 12-20 mm. long, rather narrow. Blades of petals 8-10 mm. long and with exerted claws. Banner arched to erect or less in gentle arc beyond calyx tips, oblanceolate, faintly purple-veined, little longer than the wings, seeming very narrow from the sides being much reflexed. Wings 2 mm. wide, lanceolate to linear-oblanceolate, 2 mm. shorter than banner, rounded, wider at tip, not arched, narrower and a little longer than keel. Keel obliquely lanceolate-oblong, the tip gently rounded to 30-60°, 7 mm. long, 3 mm. high. Calyx tube short-cylindric, 4 mm. long, about 3 mm. high and 2 mm. wide, a little arched, not narrowed below, truncate at base and gibbous. Teeth setaceous and variable. Pedicels nearly filiform (except in one variety) 2 mm. long. Bracts hyaline, never shorter than the pedicels, rather deciduous, with thread-like tips, variable, 2-10 mm. long. Peduncles 5-16 cm. long, shorter than the leaves, with the floral rachis 5-10 cm. long in flower and often a foot long in fruit, the spikes very dense and wide. Leaves not over 1.5 dm. long, the upper the largest, rather stout. Petioles rarely 2 cm. long, almost none above. Leaf rachis tapering and stout. Leaflets 10-16 pairs, 1-2 cm. long, 3-7 mm. wide, lanceolate-elliptical to ovate-elliptical or nearly linear, sub-alternate, contiguous, leathery, truncate to rounded and apiculate, ashy with small, flat and closely appressed hairs. Stipules lanceolate to triangular-subulate, very broad at base and connate below, often 15 mm. long. Stems stout, erect, 2-3 ft. high, sulcate, flexuous, with internodes 4-7 cm. long, several from a several crowned, erect, stout root. Grows on poor and mostly clay soil on the Plains from the Canadian Pacific R. R. southward to central Mexico, eastward into Nebraska. Not on the Pacific or Great Basin drainage. Middle and Lower Temperate life zone.

Astragalus racemosus var. *brevisetus* Jones Cont. 7 662 (1894). Bracts ovate-subulate, about 2 mm. long. Calyx teeth 2 mm. long and tube gibbous above, broadly oblong in outline, 3 mm. long, 2 mm. high, spurred. Pedicels 2 mm. long in flower, stout, longer than the bracts. Leaflets about 20 pairs. Hoary plants. This grows on the southern Plains, Nebraska to Texas.

Astragalus racemosus var. *longisetus* Jones Cont. 7 663 (1895). Bracts very long-setaceous, as long as calyx tube. Calyx teeth setaceous and long. Leaflets about 2 cm. long and 7 mm. wide, elliptical. Stipules large and reflexed. Plants mostly robust. On the northern Plains from Colorado to Alberta.

209. *Astragalus scopulorum* Porter Fl. Col. 24 (1874). *A. subcompressus* Gray, *A. rarus* Sheldon, Tium Rydberg. Pods with body about 2.5-3 cm. long, 5-7 mm. high, and 4 mm. wide, very shortly-racemose-spicate, acuminate at base into a slender stipe which is as long as or twice as long as the calyx tube, opening along

both sutures from tip to tip but valves not falling, chartaceous, a little inflated, abruptly triangular-acute at tip and tip declined and about in line with the dorsal suture as in *A. Drummondii*, arcuate or when straight the ventral suture the more convex and sharp along the edge as in *A. racemosus*, broadly linear, deeply sulcate dorsally normally reddish, with surface uneven and veiny, with dorsal suture intruded nearly to the ventral as a hyaline double partition and which opens along the lower side when mature but not along the inner edge, cross-section about cordate-ovate with sides never concave. Floral rachis rarely 5 cm. long. Flowers many, long-clawed, about 2 cm. long. Banner nearly erect in a sharp curve beginning beyond calyx tips, the erect part fully 1 cm. long, oblong-oblancoolate, 2-8 mm. longer than wings, rather fleshy below; groove V-shaped at keel tip, shallowing to nothing above; sides reflexed 2-4 mm. wide in the middle and waterlined. Wings oblong-elliptical to lanceolate, either straight or arched 45° , 4-7 mm. longer than keel, 4 mm. wide, concave to keel, widest part at keel tip. Keel straight, the blade 4 mm. long and 2-4 mm. high, the tip abruptly arched to erect and blunt, claw exerted. Calyx tube nigrescent, cylindric-campanulate, about 7 mm. long and 3 mm. high, narrowed at tip, 2-4 mm. wide, not cleft deeper above noticeably, gibbous at base and often saccate on the upper corner, upper side arched, the lower straight, green and thickened on the lower corner, horizontal in flower, teeth unequal, barely half as long as tube. Bracts dark, with hyaline edges, longer than the pedicels. Peduncles 5-15 cm. long. Floral rachis about 5 cm. long, not elongating much with age. Leaves 5-7 cm. long, all practically sessile. Leaflets thin, elliptical, truncate to rounded, 1-1.5 cm. long, green or glaucous, apiculate, 5-13 pairs. Stipules conspicuously united opposite the petiole below, large. Stems rather densely tufted, decumbent, 1-2 ft. long, branched below. Root deep, branched, erect. Pubescence almost none. In moist canons in western and southern Colorado and adjoining New Mexico and up as high as 9,000 ft. alt. Common in oak brush in the La Sals, Utah, at 7,000 to 8,000 ft. alt. It has spread to Thistle, Utah, along the railroad. Middle Temperate life zone.

210. ***Astragalus Drummondii*** Hooker Fl. Bor. Am. 1 153 t. 57 (1834). Tium Rydberg. Pods linear, curved ventrally or dorsally, about 3 cm. long, about 3 mm. wide and high, torulose, coriaceous, finely cross-nerved, with cross section reniform, very hairy within, walls soft and about 1.5 mm. thick when fresh, the tip very oblique and declined, the sutures very thick and rigid and without the thin sharp edge as in *scopulorum* and *racemosus*, and deep reddish brown, forming very strong ribs, the pod opening only a little at the tip along the dorsal suture, dorsal suture produced a very little as a thin partition except at tip but nearly touching the ventral because of pod being so sulcate. Stipe about twice the calyx. Fruiting spikes often a foot long with closely reflexed calyx. Flowers bright-white, variably yellowish when dry, many and dense. Banner ascending in a long arc remote from calyx as in *scopulorum* and about 1.5 cm. long and 7 mm. wide at base; groove V-shaped, about 1 mm. wide and high and continuing to tip. Wings obliquely lance-oblong and acute, 2 mm. wide, concave to keel and spreading 30° at tip, 3 mm. longer than keel, cream-colored, the very tips incurved. Keel 5 mm. long, bent abruptly to erect, with a small projection below the tip or the purple tip abruptly turned out as a deltoid beak. Calyx cream-colored, minutely appressed-pubescent, barely to somewhat gibbous at base and widest there, about 3 mm. high below and 2 mm. wide, 2 mm. high at tip, appearing as if urn-shaped. Teeth triangular-subulate and about half as long as the tube, the lower the longer. Pedicels 4 mm. long in fruit. Leaves 7-10 cm. long, the upper sessile the lower short-petioled. Leaflets 1.5-2.5 cm. long, narrowly to broadly elliptical, obtuse to notched,

12-15 pairs, smooth on the upper side. Stipules ovate, not connate, much acuminate. Stems very stout and strict 2-3 ft. high, nearly simple, with internodes several times shorter than the leaves, several from thick and rather woody roots. Plants much infested by insects and fungi. Pubescence shaggy all over except on the shining and smooth pods and calyx. Grows in gravelly places and clay land in the upper edge of the Lower and throughout the Middle Temperate life zone. Blooms in late summer. From the Plains of Central Colorado at least as far south as Wet Mountain Valley to the Saskatchewan, westward to head of Salina canon and near Provo, Utah, to Deer Lodge Valley, Montana. Rare in Utah.

LONCHOCARPI. 26.

This group is nearest related to the Bisulcati because of the obcompressed pod inclined to be bisulcate, 1-celled, stipitate, and opening only along the ventral suture, but in other features it approaches the Homalobi. Stems flexuous, 1-2 ft. high, rather rush-like and, like the leaves and peduncles, round, striate, green and rather fleshy and drying very slowly, slender. Stipules small, rigid, deltoid. Leaves short-petioled, of few distant leaflets or none. Leaflets nearly filiform, round in cross section or channeled, 1-3 cm. long, blunt, terminal leaflet a mere prolongation of rachis and not jointed to it. Peduncles stout, erect, with the rachis 1-2 dm. long, racemously few-flowered above the middle. Bracts minute, rather broad, shorter than the rather stout pedicels. Calyx cylindrical, truncate at both ends (triangular at base in lonchocarpus), attached near the middle, the teeth shorter than tube which is 3-6 mm. long and 2 mm. wide. Flowers about 1-1.5 cm. long, the blades half as long and sharply arched and rather wide, pearl-white to light-purple. Pods pendent on recurved pedicels which are not twisted, slightly sulcate to much obcompressed ventrally, with thick and conspicuous ventral suture somewhat raised, acute at both ends and stipitate or contracted at base and seemingly stipitate, opening along the ventral suture and inclined to be explanate, the cavity inflated somewhat, smooth to ashy, 2-6 cm. long, narrowly oblong to linear-oblongate, nearly straight, ventral suture mostly the more arched, about 5 mm. wide.

KEY.

A. Pods with stipe if any shorter than calyx.

Flowers 1-2 cm. long, white.

Pods conical-acute at both ends.

Pods with long and flat beak.

211 Kaibensis.

212 Osterhouti.

Flowers 7 mm. long, not white.

213 Duchesnensis.

2A. Pods long-stipitate, greatly obcompressed so that the cross section is nearly linear to oblately deltoid or quadrate, mostly very broadly and shallow-sulcate on each side of the thick ventral suture, pendulous, opening only along the ventral suture and explanate with age, coriaceous, often a trifle wider above, about 5 cm. long.

Whole plant green and rush-like.

214 lonchocarpus.

211. *Astragalus Kaibensis* Jones Cont. 10 64 (1902). Almost exactly similar to *A. Episcopus* except that the leaves are rarely over 5 cm. long, the pedicels sometimes only twice the bracts, and in the flowers and pods. Pods about 2 cm. long, oblong, conical-acute at both ends, 5-6 mm. in diameter and cross section about

circular, a trifle sulcate ventrally, ventral suture a little the more arched, the cavity much wider than the seeds and so decidedly inflated, smooth. Flowers white, 1-1.5 cm. long, straight, ascending. Calyx cylindrical, about 6 mm. long and 2 mm. wide, about round, with triangular rather fleshy oblique base attached on the lower corner straight with base, slightly oblique at tip, with subulate teeth from a deltoid base about 1 mm. long. Petals about as in *A. Episcopus*. The flowers approach those of *A. lonchocarpus*. Lower Temperate life zone, growing in sandy places at House Rock north of Lee's Ferry, Ariz.

212. *Astragalus Osterhouti* n. sp. Pods (including the short stipe) 3.5-4 cm. long, about 4 mm. high, slightly to much laterally flattened, the cross section being narrowly elliptical to oval, not at all sulcate at either suture, acuminate at both ends, the tip a long flat beak, the base with the rather thick sutures uniting into a stout stipe as long as or much shorter than the calyx, surface smooth, reticulations slight and wide, ventral suture inclined to be convex about two-thirds the way up, and sutures equally approaching above, but not always, with the general appearance of *A. Kaibensis*. Pods short-racemose, rather many, on pedicels 4-7 mm. long, which are several times longer than the small bracts. Flowers ochroleucous, about 2 cm. long, about as in *A. racemosus*. Banner about 1 cm. long, ovate, arched remotely from calyx to 45° , with sides much reflexed below, 4-6 mm. longer than wings. Wings about 2 mm. wide, 3 mm. longer than keel, nearly straight. Keel about 4 mm. long and 2 mm. wide, the tip very obtuse and rounded, 3 mm. high. Calyx tube 6-7 mm. long, about 4 mm. high, oblique and cleft deeper above, the base deltoid or rounded, not saccate, teeth not 1 mm. long, triangular, surface minutely pubescent with sparse and very short appressed hairs. Peduncles about a foot long, very stout, often 4 mm. thick, subterminal. Leaves about 1 dm. long, wide, of about 4-5 pairs of linear, thick, blunt, rather arcuate leaflets 2-3 cm. long and 2 mm. wide, phyllodia-like and green as are the rachis and peduncles. Petiole shorter than the lowest leaflet. The upper leaflets are almost sessile and the lower rather long-petiolulate, but all jointed to the coarse but tapering rachis. Stems probably 2-3 ft. high. Stipules small, inclined to be connate opposite the petiole. This remarkably distinct species certainly belongs here in flowers and general fruit character but other characters remind one forcibly of the *Episcopus* group. Sulphur Springs, Grand Co., Colorado. Nos. 3038 and 3235, July, 1905, and June, 1906, Geo. E. Osterhout for whom it is named. Lower Temperate life zone.

213. *Astragalus Duchesnensis* Jones Cont. 13 9 (1910). Plants with the filiform and much branched underground stems of *A. junceus*, loosely tufted with mostly single stems to a root-branch. Internodes 2.5-5 cm. long. Whole plant except the calyx ashy. Stems racemosely branched from the base and angled to about 45° . Leaves 5-8 cm. long, with about 3 pairs of leaflets 1-2 mm. wide and 1-2 cm. long, petiolulate. Peduncles and rachis about 1 dm. long. Bracts minute and deltoid. Pedicels in flower very short, in fruit 2 mm. long. Calyx and pedicel nigrescent. Calyx short-cylindric, about 3 mm. long and 2 mm. wide, reddish, cleft deeper above, not compressed, teeth rudimentary and deltoid. Flowers red to pink-purple, drying blue, banner oval, about 7 mm. long, arched to 90° in gentle arc from calyx tip, sides reflexed about 1 mm. wide, most in the middle, a little black-nerved above, notched, a trifle longer than wings, white spot with about 6 broad and white bands coming within 1 mm. of tip and sides, sulcus shallow and very broad. Wings lunate-oblongate, 2 mm. wide, a little narrowed above, obtuse, arched about 45° , white, entire, flat to the keel and about 1 mm. longer. Keel with arched base, tip very broad, incurved more than 90° , about 2 mm. high, black-purple tipped, surpassing calyx by 5 mm., tip deltoid at end. Pods white when young, nearly straight but arcuate rather more below or sometimes forming a slight S

by being reversed curved at tip, linear-oblongate to broadly linear, 3-6 cm. long, 5-7 mm. wide above the middle, obcompressed ventrally and with a slight concavity but not bisulcate, cross section often flat to deltoid, hairy within, a little inflated, chartaceous to leathery, apiculate to very acute at tip and narrowed to a very broad pseudostipe at base. Ventral suture a little raised, dorsal impressed. Pod reddish to green. Common on the sandy mesas from 13 miles below Theodore, Utah, to Chepeta Well, Colorado, and the White river. Lower Temperate life zone. *A. pinonis* Jones is very liable to be this species when that species is better known, but so far the calyx teeth are very much longer and pod not obcompressed.

214. *Astragalus lonchocarpus* Torr. Pac. R. R. Rep. 4 80 (1857). *Phaca macrocarpa* Gray Pl. Fend. 36 (1849). *Tragacantha lonchocarpa* (Torr.) Kuntze, *Homalobus macrocarpus* (Gray) Rydberg. Pods about straight, 5-7 mm. wide, sharply acuminate at both ends and long-acuminate at base, broadly linear-oblongate to even linear-elliptical, faintly cross-ribbed, with both sutures very prominent when dry, fleshy and oblatly oval in cross section when fresh and pods with woody fibers running lengthwise which appear as red dots in the pulp of cross sections; dorsal suture raised and nerve-like; stipe at least twice the calyx. Flowers many, pearl-white and rather fleshy, rarely purple, loose, horizontal to reflexed, 1-1.5 cm. long, with rather broad blades. Banner arched to 90-110° 3 mm. beyond the calyx teeth in a gentle arc, 7 mm. longer than keel, oblique, narrowly oblong from a broad base; groove narrowly U-shaped, 1 mm. wide, 1.5 mm. deep and extending to calyx tips, shallower above and open. Wings linear but wider 2 mm. below tip, arched so as to cover the center of keel, 2 mm. wide, flat to keel but concave beyond it, not spreading, close-pressed to it and 5 mm. longer. Keel bent in a sharp curve to 100°, with straight base, the erect part 3-4 mm. high and as long as the base, mostly purple-tipped but yellowish otherwise. Calyx tube 5-7 mm. long, nearly cylindric, hyaline, 2 mm. high, 1.5 mm. wide, with thickened and green bracteolate and oblique base, reddish, cleft a little deeper above, tapering at base into the pedicel which is reflexed in fruit; teeth slender to deltoid, about 2 mm. long, half the tube or less, broadly subulate, not spreading. Bracts very small, half as long as pedicels or less in fruit. Pedicels stout, strigose, 5-7 mm. long. Peduncles in flower longer than the spikes, in fruit often less, 1-3 dm. long, not manifestly grooved when fresh but decidedly so when dry, strict and erect, subterminal, densely flowered above. Leaves leathery, fleshy when fresh, not over 8 cm. long. Leaflets none to 3 pairs, linear to filiform, rarely wider than the green rachis and always like it, 1.5-3 cm. long, distant, obscurely jointed to rachis, sessile, the rachis often leafless and then 5-8 cm. long, the end leaflet not conspicuously and rarely at all enlarged. Stipules distinct, or connate below, small. Stems many, conspicuously grooved, densely tufted, branched, tall, the branches not tangled, from a fleshy and erect taproot, the internodes 8 cm. long or less. Pubescence hoary, composed of wide, flat, very short and appressed hairs throughout except on the pods which are nearly smooth. It grows in poor and alkaline soil and has the habit of *A. junceus* but without the underground and branching roots and grows in large tufts around alkaline seeps and similar slopes and washes. The peculiar rush-like habit with stems and leaves equally green cause it to be overlooked. From Pioche, Nevada, northward to Ferguson Spring near Ibapah, Utah, eastward from Pioche north of the Grand Canon along the Virgin (north to Cedar City) and the Kanab region, throughout the Navajo Basin drainage, eastward through Durango and the Little Colorado to the Rio Grande, thence northward to Pueblo and Canon City. Lower Temperate life zone in very poor alkaline soil either sand or clay.

HAMOSI. 27.

Pods linear or narrow, 1-4 cm. long (rarely 2 cm. long), rarely 5 mm. high, nearly always laterally flattened and inclined to be triquetrous in cross section and to have concave sides; mostly acuminate or sharp-pointed, 2-celled or with dorsal suture very much intruded, nearly always sulcate dorsally, rarely so ventrally and with ventral suture mostly sharp and raised, not inflated (a little so in *Mulfordæ*), rigid, coriaceous only in *glaber* and *A. distortus* and then somewhat fleshy, chartaceous (papery in *Mulfordæ* and *Inyoensis*), variably arcuate. Flowers small, rarely 1.2 cm. long, in racemes (in short spikes in *sylvaticus*-*Nevinii* groups, and in heads in *A. calycosus*). Slender perennials (*A. Inyoensis* and *albens* probably are winter annuals) spreading over the ground in small tufts. Stipules connate only in *A. Andersoni*. Plants of the Lower Temperate life zone but extending a little into the adjoining zones.

KEY.

A. Pods not reflexed, sessile.

AB. Pods nearly round to reniform in cross-section, not jointed to calyx, inclined to be narrower below. Flowers with campanulate calyx. Leaves nearly sessile, with many pairs of leaflets. Pubescence attached by the base, not hoary except in *A. Coahuilæ* when young. Plants of New Mexico and eastward.

ABC. Pods cartilaginous, inclined to be fleshy when green, lunate to linear-oblongate, acuminate at both ends, cross-section about reniform, rarely triquetrous-cordate. Calyx teeth shorter than the tube. Flowers rather many and nearly capitate. Leaflets elliptical. Stems diffuse and spreading.

Pods lunate and tapering at both ends. 215 *distortus*.

AB2C. Stems erect, a foot or so high. Flowers few in loose racemes. Pods coriaceous only in the first species.

Flowers 1 cm. long, white. 216 *glaber*.

Flowers 8 mm. long, purple. 217 *Coahuilæ*.

A2B. Pods spreading, inclined to be jointed to the calyx, 2-celled, nearly linear (sometimes oblong in *A. calycosus* and then small), somewhat laterally flattened to nearly round in cross-section and about triangular-cordate, chartaceous, pubescent, not less than 7 mm. long, 2-4 mm. high, a little arcuate, not reflexed, pungently beaked, narrowed at base but not stipitate. Flowers 7-10 mm. long, light-colored, short and stubby much as in *A. junceus*, in heads or short racemes which are long-peduncled, broad, ascending, with broad petals and enlarged or lobed wings. Calyx campanulate, about 4 mm. long and 2 mm. high, with short teeth. Pedicels about 2 mm. long and longer than the small bracts. Peduncles 1-1.5

dm. long, longer than the leaves. Leaflets obovate to oblong-ovate, rarely linear. Stems branched from the base or aculescent. Pubescence hoary, of flat and appressed hairs attached by the middle. Stipules triangular and small, not connate. Species closely allied to *Oxytropis*. *Oxytropidoides*.

Pods acuminate. Stems long and prostrate.

208 Arizonicus.

Pods not acuminate. Stems almost none.

219 calycosus.

2A. Pods stipitate or reflexed. Pubescence attached by the base.

2AB. Pods erect on a stipe shorter than the calyx and jointed to it, triquetrous, with concave sides, linear, 2-5 cm. long, 2-3 mm. high, acute at both ends, slightly larger toward the tip, smooth, with cross-section Y-shaped. Flowers ascending, few and racemose. Banner oval, 5-6 mm. long, abruptly arched at calyx tips to erect or more. Wings about linear. Keel blunt. Bracts minute. Peduncles shorter than the leaves. Leaflets thick, flat, distant. Calyx spreading to horizontal in fruit. Pubescence ashy and closely appressed when present. Stems rather rush-like and round, colored like the leaves. Hairs short, flat, white but inclined to be dark on the calyx. Plants of the Californian deserts. *Orcuttiani*.

Leaflets about 4 pairs.

220 Bernardinus.

Leaflets about 15 pairs.

221 tricarinatus.

2A2B. Pods deeply sulcate dorsally, generally obcompressed below, and much arcuate, chartaceous barely wider above, about 2-3 cm. long and 2 mm. high, smooth, on stout stipe shorter than calyx and not jointed to it, cross section rather deltoid or oblately so, with the same peculiar, stubby, declined tip as in *A. Drummondii*. Leaflets about 12 pairs, gradually smaller above, distant, nearly round, on very short petioles and with long and tapering leaf-rachis. Tropical.

Pods with concave sides, and flowers about 7 mm. long. 222 *Orcuttianus*.

2A3B. Pods reflexed (apparently ascending in the *A. Nevinii* group or at least indifferently spreading), triquetrous in cross-section, never straight.

2A3BC. Pods not stipitate, jointed to calyx, linear, much arcuate. Flowers small.

Pods arched to a half circle.

223 drepanolobus.

2A3B2C. Pods stipitate (minutely so in *A. Congdoni* and *Andersoni*).

2A3B2CD. Pods jointed to a stipe which is shorter than the calyx, linear to narrowly oblong.

2A3B2CDE. Whole plant softly silky, even the pods pubescent. Pods with cordate cross-section, slightly sulcate dorsally. Flowers white or whitish, with elongated banner 1-1.5 cm. long. Calyx tube about 4 mm. long, rather truncate below and inserted on the corner, cleft deeper above and oblique. Leaflets elliptical and apiculate. Pubescence of very fine, long, twisted or wavy, nearly smooth hairs.

Pod closely reflexed.

224 *Congdoni*.

Pods not closely reflexed.

225 *Andersoni*.

2A3B2CD2E. Whole plant smooth or nearly so including the shiny pods. Flowers small.

Pods arched to a half circle.

226 *sylvaticus*.

2A3B2CD3E. Pods shortly appressed-pubescent, tapering into a short stipe, with broad cross-section. Leaves silvery-hoary with short and appressed hairs. Flowers small.

Pods arched nearly to a circle.

227 *albens*.

2A3B2C2D. Pods not jointed to stipe which is mostly longer than the calyx, nearly straight (much arched in *A. Inyoensis*).

2A3B2C2DE. Pods rather abruptly contracted at both ends, never linear not wider than oblong. Perennials (except *A. Inyoensis*).

2A3B2C2DEF. Pubescence never white-woolly, plants not shrubby above the base. Pods reflexed, about 4 mm. high, very oblique, but not arcuate evidently. Flowers small, stubby, with broad keel, not over 1 cm. long, racemose. Slender plants. Leaflets 6-9 pairs, not over 1 cm. long, thick.

2A3B2C2DEFG. Pods 2-3 cm. long including the stipe, and at least 5 times as long as high probably reflexed but appearing ascending. Upper leaves about sessile. Pubescence somewhat scanty and of soft and very fine and short tangled hairs, inclined to be ashy. Flowers white.

Pods with tip and base long.

228 *Howellii*.

2A3B2C2DEF2G. Pods about 1 cm. long, with body not over three times as long as wide, papery, a little inflated, abruptly short-pointed and half-oval or arcuate-oblong, with deltoid cross-section, with ventral suture raised and thickened. Banner about 5 mm. long, oval. Calyx tube about 2 cm. long, acute at base. Blooming in May.

Pods not long-beaked.

229 *Mulfordae*.

Pods long-beaked.

230 *Inyoensis*.

2A3B2C2DE2F. Plants white-woolly, with woody stems, densely congested, prostrate, densely leaved and with short internodes. Peduncles stout, longer than the leaves. Leaflets oval-obovate 6-9 mm. long. Stipules small and inconspicuous. Ventral suture raised and thickened but not produced as a sharp edge.

Pods smooth.

231 *Nevinii*.

Pods short-woolly.

232 *Traskiae*.

2A3B2C2D2E. Pods very narrowly linear and greatly elongated, 4-6 cm. long and hardly 3 mm. wide or high, long-acuminate at both ends, reflexed. Perennials.

Pods almost filiform and very long.

233 *Arthuri*.

215. *Astragalus distortus* T. & G. Fl. 1 333 (1838). *Tragacantha* Kuntze, *Tium* Rydberg. Pods from lunate and conspicuously tapering at both ends to oblong-obovate, lanceolate or oblanceolate and less sharply pointed, variable on the same plant, reniform to didymous in the type in cross-section, with both sutures intruded and sulcate on both side of the pod, but sulcate most along the dorsal suture and that suture variously produced but mostly nearly touching the ventral, pod inclined to be obcompressed in the type, much arched or very oblique but tip straight and symmetrical and triangular to apiculate, pod often twisted and rugulose with uneven sides, rather smooth and reticulated except close to the ventral suture, rarely truncate at base, swollen in the middle, 2-4 cm. long, about 5 mm. wide and 3-4 mm. high, sessile or with minute stipe. Flowers 10-20, purplish to nearly white, 7-12 mm. long. Banner elliptical, about 7-10 mm. long, deeply notched, gently arched to 45° at end of calyx tips, sides reflexed. Wings narrowly oblong, a little arched, about 1 mm. wide, 2-3 mm. longer than keel and about as much shorter than banner. Keel about 4 mm. long, surpassing the calyx, arched in about a half circle, 1-2 mm. wide, 3 mm. high

at the rounded and nearly erect and purple tip. Calyx tube narrowly campanulate, about 3 mm. long, attached near the lower corner, the broadly triangular teeth about half as long and nigrescent. Pedicels about 2 mm. long, longer or shorter than the ovate to triangular-subulate bracts. Peduncles 1-2 dm. long, filiform, rather spreading. Spikes rounded to oblong. Leaves about 1 dm. long, weak and lax and with tapering rachis and evident petioles even above. Leaflets 7-19 (mostly 10) pairs, all about the same size on each leaf, the well developed ones oblong to obovate, with cuneate and long-petiolulate base, hardly 1 cm. long, those of the lowest leaves often very small and oval, usually notched. Upper internodes the shorter. Stems 1-2 ft. long, weak and straggling. Stipules rather broad, acute, green and spreading, 3-5 mm. long. Plants nearly smooth. From Mason Co., Ill., and eastern Kansas to Oklahoma and southern Texas and Mississippi on prairies and margins of woods. Lower Temperate life zone mostly. Blooming in spring.

Astragalus distortus var. Engelmanni (Sheldon Minn. Bot. Stud. 9 152 (1894) as species). Pods lunate, reticulated, with cross-section triangular-cordate, the dorsal suture intruded only as a raised line, coriaceous, not obcompressed, 4-5 mm. high. No. 145 E. Hall from open woods at Houston, Texas, in flower and fruit in April. Also Indian Terr. (Oklahoma) by Carleton.

216. Astragalus glaber Mx. Fl. 2 66 (1803). *A. apilosus* Sheldon. *Tragacantha Michauxii* Kuntze. Pods narrowly oblong to linear, 1.5-2.5 cm. long, 4-6 mm. high or wide, coriaceous, acute at both ends and a little curved below, somewhat swollen in the middle, inclined to be obcompressed when mature, shallow-sulcate dorsally, smooth, reticulated, not fully 2-celled the suture being intruded half way, with triangular-reniform cross section. Flowers white, spreading to reflexed, a little over 1 cm. long, not narrow. Banner 6-8 mm. long, sharply arched at calyx tips to erect, about 4 mm. longer than wings, with sides reflexed below. Wings oblanceolate, little longer than keel, about 2 mm. wide, arched 45°. Keel about 6 mm. long, the base a trifle convex, then abruptly erect and tip 4 mm. high, triangular, but obtuse, the base about 3 mm. high. Calyx about 5 mm. long and 3 mm. high, nearly truncate below and attached on the lower corner where it is a little fleshy, not oblique above, with broad and rounded sinuses and narrowly triangular teeth about 1 mm. long, hyaline. Pedicels slender, 2-3 mm. long, rather longer than the ovate bracts. Peduncles about as long as leaves, the rachis as much more, slender. Leaves 6-8 cm. long, tapering, scattered (because of the slender internodes). Leaflets 7-18 pairs, 1-2 cm. long, linear-elliptical, thick, the lower ones obtuse to notched, conspicuously reduced above on the rachis. Stipules minute, spreading. Stems strict, very sulcate, about 2 ft. long. Pubescence none throughout except on the lower side of leaflets and calyx. North Carolina, Georgia and Florida on barrens. Blooming in summer. Lower Temperate life zone.

217. Astragalus Coahuilæ n. sp. Pods linear-oblong, chartaceous, nearly straight, triangular-acute, 2-celled except at tip, flattened laterally, or nearly round, nearly smooth, about 1.5 cm. long and 3-4 mm. high, inclined to be sharply sulcate dorsally. Flowers few, purplish, about 8 mm. long. Banner oval, arched abruptly at calyx tips to 45° or erect, 6-7 mm. long, with sides reflexed 1 mm. wide below, with narrow white spot purple-veined. Wings lanceolate, arched to 45°, about 2 mm. longer than keel and 4 mm. shorter than banner. Keel with straight base and then abruptly rounded to a little more than erect and with deltoid tip 3 mm. high. Calyx tube about 3 mm. long, acute at base and about equally inserted, nigrescent, oblique at tip, and cleft deeper above, the sinuses rather narrow, the teeth subulate and nearly as long as tube, black. Pedicels slender 2-3 mm. long, a little longer

than the triangular bracts. Peduncles 5-7 cm. long, slender, rather shorter than the leaves and rather longer than the rachis. Leaves 6-8 cm. long, narrow, somewhat tapering, longer than the internodes, nearly sessile. Leaflets about 10 pairs, elliptical, obtuse, about 1 cm. long, rather ashy with wavy and rather loose short and fine hairs, young parts hoary. Stipules green, triangular, reflexed, hardly 5 mm. long. Stems about 2 ft. high, much branched, apparently from a woody root, a little floerous. Parras Coahuila, Nos. 1078 and 4672 Purpus. Tropical, blooming in spring and fall. Dr. Matthews's specimens from Fort Wingate, New Mexico, in the Gray herbarium in flower only are much the same but with linear leaflets and longer calyx tube and very long lanceolate bracts. Probably another species.

218. *Astragalus Arizonicus* Gray Proc. Am. Acad. 7 398 (1868). Pods 2-4 cm. long, linear, a little arcuate, rather closely appressed-erect, with spreading tips, occasionally slightly sulcate dorsally but very narrowly so, both sutures rather prominent, much laterally flattened, not densely pubescent, occasionally rather torulose, with ventral suture forming a strong rib, raised, concave along the middle, convex at both ends, and beak straight and arising from a little above the middle of the end, and about 4 mm. long, the pod abruptly contracted into it, cross-section narrowly triangular-cordate. Flowers about 1 cm. long, many, in short racemes, dirty-white and with purplish edges. Banner oval, arched to erect either remotely from or at calyx tips, about 7 mm. long, with sides reflexed 2 mm. wide below, barely longer than keel. Wings not longer than keel, narrowly oblong, 2 mm. wide, entire, rounded and very oblique, purple below, whitish above, the tips incurved and horizontal. Keel arched a little below, then abruptly erect and produced into a sharp tip 3-4 mm. high, large, dark-tipped, 5 mm. long. Calyx tube campanulate, about 3 mm. long, acutish at base and equally inserted, a little oblique at tip, cleft deeper above, with rounded sinuses, closely appressed-nigrescent, a little obcompressed above with fleshy base, on a short and stout pedicel about as long as the ovate bract, teeth flaring, triangular, rather unequal, shorter than the tube, or nearly as long. Peduncles stout, spreading, 1-2 dm. long. Leaves 7-10 cm. long, the upper nearly sessile, wide. Leaflets 4-7 pairs, linear and acute to elliptical and rounded, the narrower ones 2-3 cm. long, the wider ones about 7 mm. long, distant, rather long-petiolulate. Stipules small, triangular, brown, about 3 mm. long. Stems more pubescent than the leaves, woody at base, procumbent to prostrate, flexuous and often much so. Pubescence hoary and a little loose. On the western and southern flanks of the Mogollon plateau from the Chimihuevis Mts. to central Mexico, Lower Temperate and upper part of the Tropical life zones. Blooming in April and May.

219. *Astragalus calycosus* Torrey Bot. King 66 t. 10 (1871). *A. brevicaulis* Nelson. *A. cyanoseminis* Greene. *Hamosa* Rydberg. Pods 7-25 mm. long, oblong to linear, abruptly acute and with a short apiculation to tapering and the beak 3 mm. long with beak in line with the ventral suture, rather deeply and narrowly sulcate dorsally, with cross section oblong-obovate-cordate, nearly straight to decidedly arched, the ventral suture concave throughout, but little raised and narrow. Flowers few, capitate, mostly 1 cm. long. Banner abruptly arched at calyx tips to erect, white or purple, oval, about 5 mm. long or less, deeply notched, with sides reflexed about 1 mm. wide, much longer than the keel and a little longer than wings. White spot broad, cuneate, broadly notched, groove rectangular and wider than high. Wings very closely appressed to keel throughout, red-purple to keel tip and white beyond, deeply cleft into 2 lobes, the lower ones oblong, 2-4 mm. long, straight and like normal wings, the upper one-third wider and erect, both lobes rounded and narrow at tip (usually there is a fine thread almost as long as the lobes coming out at their junction), 2-3 mm. longer than

keel, 1 mm. shorter than banner. Keel claw enlarged just above the calyx so as to make a hollow in the banner, with decided hump at base, purple-tipped, the base a little arched, then sharply rounded to erect, the blade forming about a half circle, acutish to very obtuse, 4 mm. long, 2 mm. high. Calyx tube campanulate, 3-4 mm. long, cleft deeper above, with rounded sinuses, oblique at base and inserted on the lower corner, silvery to nigrescent and densely pubescent, teeth triangular, rather lax, about half as long as tube. Bracts ovate, about 1 mm. long. Pedicels 1-3 mm. long in fruit. Peduncles filiform, erect in flower, mostly flat on the ground in fruit, from 1-15 cm. long, in the diminutive forms concealed in the leaves, in more robust ones 4 times as long as leaves, 2-6 flowered, scapose. Leaves 2-10 cm. long, with filiform petiole twice as long as rachis, fascicled on the very short crowns. Leaflets 1-3 pairs, oblong to obovate, 2-10 mm. long, silvery on both sides, usually acute, thick, flat, on the lowest leaves often there is but one obovate leaflet. Stipules large, deltoid, imbricated mostly, 3-5 mm. long. Stems reduced to many short crowns in dense but small mats crowning a long, slender, erect root. Growing on gravelly meses but well drained and on rocky ridges from the foothills to 10,500 ft. alt. on Mt. Ibapah, Utah. Common from the bad lands of western Wyoming to Pocatello, Idaho, and Glenwood Springs, Colorado, to the Mogollons and the Sierras. Lower and Middle Temperate life zones. Blooming in spring. A very variable plant. The starved plants are as dense and short as a caespitose phlox. Those growing in the shade are long-petioled and long peduncled. The pods vary from about as long as calyx and teeth to an inch long.

Astragalus calycosus var. scaposus (Gray) Jones Cont. 4 26 (1893). *A. scaposus* Gray Proc. Am. Acad. 13 366 (1878). *A. candicans* Greene. Pods about 1 cm. long, densely pubescent, only slightly flattened, about half included in the long calyx, straight. Flowers reddish-purple, rarely white. Petals barely twice the calyx, rather stubby. Banner obcordate, a little longer than keel and equaled by the wings. Lobing of wings very variable. Calyx oblong-campanulate, teeth deltoid and about 1 mm. long, not lax. Peduncles often 2 dm. long. Heads oblong, 6-12 flowered. Leaflets 3-5 pairs. Along the Colorado river from McElmo Cr. Colorado to Hackberry, Arizona, and Owen's Valley, California. Lower Temperate life zone.

220. Astragalus Bernardinus Jones Cont. 7 661 (1895). Pods apiculate, 2.5 cm. long, about 3 mm. high at tip and 1 mm. high at base, shallow-sulcate dorsally, completely 2-celled, very finely reticulated, ventral suture acute, dorsal angles rounded. Flowers 6-10, reflexed, 6-8 mm. long. Banner about 2 mm. longer than wings. Wings arched to erect, about 1 mm. longer than keel. Keel arched to a half circle from base, 3-4 mm. high and long, rather obtuse. Calyx tube 2-3 mm. long, rounded at base and about equally inserted, the sulcate teeth about as long. Pedicels very short. Peduncles not over 2.5-3 cm. long, rachis about as long or twice as long. Leaves 5-7 cm. long, the rachis like the stems green and tapering, curved. Leaflets about 4 pairs, narrowly-oblong, about 1.2 cm. long and 3 mm. wide, obtuse but not notched, equally rounded at both ends, ashy on both sides, the upper pairs reduced, on very weak petioles. Stipules triangular, green, evident. Stems about 2 dm. long, ascending, slender, with internodes not over 3 cm. long. Eastern base of the San Bernardino Mts., California, Lower Temperate life zone, at Cushenberry Canon, Parish; Barnwell Mrs. Brandegee, Charleston Mt. Purpus. Blooming in May.

221. Astragalus tricarinatus Gray Proc. Am. Acad. 12 56 (1876). Pods broadly linear, arcuate a little at maturity, apparently 3-keeled by the concave sides making 3-angles, broadly sulcate dorsally, about 3.5 cm. long and 5 mm. high, smooth, the ventral suture very acutely keeled. Flowers spreading, white, about 1-2 cm. long. Banner about 5 mm. long, with sides much reflexed

and nearly 2 mm. wide. Wings nearly linear, arched to 45° , a little longer than keel and 3-4 mm. shorter than banner. Keel with straight and thick base and then abruptly erect, about 3 mm. high at tip and darker. Calyx about 3 mm. long and high, equally inserted and not oblique, with broad sinuses and subulate teeth a little shorter than tube, on a slender pedicel 2-3 mm. long which is longer than the triangular bract. Peduncle 2-3 dm. long, the rachis half to a third as long. Leaves nearly 2 dm. long, very narrow, nearly sessile and with long and tapering rachis, ascending. Leaflets about 15 pairs, 7-10 mm. long, oval to broadly elliptical, rounded to notched, silvery-white above with closely packed and appressed short hairs, green below. Internodes very short, rarely 2 cm. long, stems erect and slender, about a foot high, from a woody base. Whitewater at the Base of the San Bernardino Mts., California, Parry; San Emigdio Canon Kern Co. Cal. Davy. Tropical.

222. *Astragalus Orcuttianus* Watson Proc. Am. Acad. 20 361 (1885). Pods with erect tips but calyx rather reflexed, widely sulcate, 2-celled except at tip, sides concave, ventral suture a sharp edge. Flowers about 7 mm. long, pink, short and stubby. Banner oval, nearly 7 mm. long, abruptly erect at calyx tips, about 3 mm. longer than wings. Wings oblong, arched to 45° , about 1 mm. longer than keel. Keel very short, with straight base and then abruptly erect to the triangular and acute tip which is about 3 mm. high. Calyx about 2 mm. long, acute at base and equally inserted and not oblique, inclined to be oblique at tip and cleft deeper above, the triangular teeth a little shorter than the tube, hyaline and very thin. Pedicels slender, 2-4 mm. long, much longer than the triangular bracts. Peduncles axillary, rarely 5 cm. long, about as long as floral rachis in the type. Leaves 7-12 cm. long. Leaflets round to oval, 3-7 mm. long, with broadly cuneate base, distant, thin, notched, 8-12 pairs, smooth. Stipules small and recurved. Stems very slender and branching from a woody base, many, decumbent, a foot long, with very short internodes. Whole plant smooth, but young parts minutely pubescent. Cantillas Canon Lower California, Orcutt. Brandegee's material from San Enrique L. Cal. has very long floral rachis and many pods.

Astragalus Orcuttianus var. *Gregorianus* Jones Cont. 10 63 (1902). Pods equally arched to a quarter circle, narrowed and obcompressed below, laterally flattened above and about 3 mm. high, deeply sulcate at base and little so at tip which is abruptly acicular and declined and nearly in line with the dorsal suture, ventral suture raised as a sharp and thin edge, pods smooth, chartaceous, finely reticulated, about 2-5 cm. long. Flowers about 1 cm. long, broad, pink. Banner oval, about 1 cm. long, with sides reflexed nearly 4 mm. wide at base, arched abruptly at calyx tips to 60° , about 4 mm. longer than wings. Wings obliquely obovate, arched 30° , about 1 mm. longer than keel, 2 mm. wide. Keel as in the type and about 4 mm. high and as long. Calyx tube very oblique above and teeth unequal, about 1 mm. long. Peduncles with floral rachis about a foot long. Leaflets obovate to obovate, about 1 cm. long. San Gregorio and San Enrique L. Cal. in Bloom in February. Brandegee.

223. *Astragalus drepanolobus* Gray Proc. Am. Acad. 19 75 (1885). Pods about 2 cm. long and 2-3 mm. high and 1 mm. wide, smooth and shining, arched to about a half circle, a little narrowed at both ends, rounded and obtuse at base, triangular-acute at tip, finely reticulated, papery, 2-celled except at tip, with a sharp and narrow sulcus, the ventral suture a mere line and not raised. Flowers about 5 mm. long, broad, white. Banner nearly round, about 4 mm. long, arched abruptly near end of tube to 45° - 80° , with sides reflexed 1 mm. wide and most below about 3 mm. longer than wings. Wings oblong-linear, arched 45° , acutish, fully 1 mm. longer than

keel. Keel about 3 mm. long, nearly straight then abruptly erect and tip a little out-turned and acutish, nearly 3 mm. high, about equaling the calyx tips, purple-tipped. Calyx tube about 2 mm. long, acutish and a little oblique at base, about equaled by the subulate teeth, nigrescent. Pedicels very short and bracts minute. Peduncles filiform, rather shorter than the leaves, 2-3 cm. long, axillary, hardly as long as the fruiting rachis. Leaves 3-4 cm. long, with the petiole nearly as long as its rachis, many but open. Leaflets 4-5 pairs, rather obovate, often notched, nearly 1 cm. long, not contiguous. Stipules small. Stems very slender and flexuous, weak and spreading, branched, apparently from slender underground stems from a perennial root, but possibly winter annuals, about a foot long. Blooming in May. John Day river Oregon Howell. Middle Temperate life zone.

224. *Astragalus Congdoni* Watson Proc. Am. Acad. 20 360 (1885). Pods minutely pubescent when mature, densely so and often nigrescent when young, shortly acuminate and inclined to have tip declined, reticulate, loosely racemose, closely reflexed, about 2 cm. long, and 2-3 mm. wide and high, rather cordate in cross section, the ventral suture thick and with sharp edge along the middle, barely acute at base. Flowers white, narrow, rather closely racemose, reflexed. Banner oblong-ovate, about 1 cm. long, arched abruptly about 2 mm. beyond calyx tips to 45° , with sides reflexed about 1 mm. wide below, nearly 5 mm. longer than wings. Wings oblong, arched 30° , about 2 mm. longer than keel. Keel about 4 mm. long and high at tip, the base proper about 1 mm. long, the rest a rather deltoid erect and acutish not darker tip 4 mm. high. Calyx tube about 4 mm. high inserted near the lower corner on a stout black pedicel, black-woolly, teeth rather shorter than the tube, subulate from a broad base, the lower the longer. Pedicels almost none. Bracts hyaline, triangular, about 3 mm. long. Peduncles about 1 dm. long, sulcate and stout mostly, as long as or shorter than the fruiting rachis, erect. Leaves 5-10 cm. long, narrow and tapering, the upper sessile or short-petioled, the middle ones the largest, with 8-10 pairs of leaflets 1-1.5 cm. long which are contiguous, softly silky with hairs often tangled. Internodes congested below and stems very leafy. Stipules green, large, deltoid. Stems decumbent, slender, about a foot long, rather simple but with many woody branches at base. Fisher's Cabin and Hite Cove in the Sierras. Middle Temperate life zone. This grows in rocky places and blooms in May and June. Collected by Congdon.

225. *Astragalus Andersoni* Gray Proc. Am. Acad. 6 524 (1865). Pods 1.5-2 cm. long 3-4 mm. high, about 2 mm. wide, narrowly-oblong to nearly linear, triangular-acute to blunt and apiculate, nearly straight to arched to one-third circle, mostly a little reflexed, rounded at base, early falling off and leaving the empty calyx, with ventral suture raised and thickened and sharp along the middle, splitting the calyx, 1-celled at tip, with cross section narrowly to broadly cordate, narrowly sulcate dorsally, softly and variably silky-woolly. Flowers normally white but often pink or tinged with pink, short and stubby, broad, in heads at first or spicate and ascending, later inclined to horizontal. Petals very thin, rather translucent. Banner oblong-ovate to oval, 6-8 mm. long, arched abruptly at end of teeth to 45° or rarely erect, with sides reflexed about 2 mm. wide below, about 4 mm. longer than wings; groove U-shaped below, and V-shaped above; white spot striped when present, wings oblong-obovate, very oblique, acutish, about 2 mm. wide, notched, concave to keel and touching beyond it, purplish below and white above or all white, 1-2 mm. longer than keel, inclined to be oblanceolate and wavy toward tip, variously arched. Keel about 4-5 mm. long and 3 mm. high, half-cuneate obovate and with tip obliquely truncate, purple above.

Calyx tube about 3 mm. high, reddish, the filiform-subulate teeth very lax and about as long as tube. Pedicels almost none to 2 mm. long, much shorter than the subulate to triangular bracts which are 3-4 mm. long, hairy and hyaline. Peduncles stout 5-10 cm. long, the fruiting rachis about as long, spreading. Leaves rarely 5 cm. long, rather broad, all petioled but upper petioles short, spreading. Leaflets rather thick, 6-8 pairs, hardly 1 cm. long, folded. Stipules small, connate below, triangular. Stems flexuous, about 1-2 ft. high, from a woody base, rather many. Sierra Valley to Owen's Valley California on the eastern base of the Sierras growing in the sagebrush, Lower Temperate life zone. Whole plant softly silky-woolly. Blooming in May. The Owen's Valley forms have larger and purple flowers and pods 5 mm. high and 2 cm. long.

226. *Astragalus sylvaticus* Watson Proc. Am. Acad. 23 262 (1888). *A. umbraticus* Sheldon. Pods not tapering at base, obtuse or abruptly acutish, smooth and shining, closely reflexed, chartaceous, arched to a half circle, about 1.5 cm. long, 2-3 mm. high and 1 mm. wide, narrowly and deeply sulcate dorsally, with cross section narrowly Y-shaped, tip triangular-acute, ventral suture a mere line and not raised. Flowers white, many, in a short spike, drooping, about 1 cm. long, with delicate petals and none colored except keel tip, not narrow. Banner about 5 mm. long, oblong-ovate, abruptly arched at calyx to nearly erect, fiddle shaped by the sides being reflexed most near the middle (and about 2 mm. wide); groove broadly V-shaped, about 1 mm. deep and 2 mm. wide and goes almost to tip of banner without shallowing, deeply notched, cream-white, faintly waterlined. Wings close-pressed to keel and convex to it to the middle then the right hand one flares, very obliquely oblong-lanceolate, 2 mm. wide, very obtuse and rounded and erose at tip, 1 mm. longer than keel and about as much shorter than banner. Keel large, about 3 mm. long and high, arched from base to about a half circle. Calyx oblong-campanulate, about 3 mm. long, a little flattened laterally, yellowish and nigrescent, the lower side straight, the upper a little arched, rather oblique at base and attached a little below the middle, cleft deeper and oblique at mouth. Teeth filiform from rounded sinuses. Pedicels about 1 mm. long. Bracts hyaline, triangular-subulate, about 3 mm. long and lax. Peduncles slender, strict, about as long as leaves and 1 dm. long, in the upper axils, the rachis about 2-3 cm. long and closely flowered. Leaves slender, not over 1 dm. long, spreading, the upper sessile, with tapering and filiform rachis, only the uppermost leaflets reduced. Leaflets about 10 pairs, oblong-elliptical, notched, rounded and very short-petiolate at base, green, flat, thin, contiguous, smooth or nearly so. Stipules about 1 cm. long, subulate, hyaline above. Stems about 2 ft. long, slender, flexuous ascending to erect, with internodes 2-7 cm. long, from slender and erect tap root, several at the small crown. The root leaves much reduced. In shaded woods in open places in rich soil. Glendale, Oregon, Middle Temperate life zone.

227. *Astragalus albens* Greene Bull. Cal. Acad. 3 156 (1885). Pods broadly linear, acuminate at both ends, arched mostly to a circle, a trifle wider above, when young much laterally flattened and little arched, when mature coriaceous, strongly corrugated, 2-3 cm. long, 3 mm. wide and high, flat for about 1 mm. high along the ventral suture and forming a thick wing but the suture itself not raised, then much bulged outward in nearly a half circle and re-entering as a broad sulcus on the dorsal suture so that the cross section of pod is deeply cordate and winged at the tip, each cell being oval, 2-celled throughout or the partition reaching only half way to the ventral suture, the base of pod is 3-cornered like a file, the tip is very sharp and flat because the sulcus stops about 5-8 mm. from the end, ashy. Flowers few and racemose, purple, about 8

mm. long, wide, spreading. Banner about 4 mm. long, oval, arched abruptly at calyx tips to 45° , with sides reflexed about 1 mm. wide, about 2 mm. longer than keel. Wings obliquely lanceolate and arched a little, about 1 mm. wide, much narrower than keel and about as long. Keel large, nearly 4 mm. long and high, a little convex along the base and much rounded and very obtuse, the whole forming almost a half circle, much separated from banner. Calyx tube about 3 mm. long, acutish and narrowed at base, about equally inserted, oblique and deeper cleft above, with rather sharp sinuses and triangular teeth fully half as long as tube, very closely appressed hoary. Pedicels stout, about 1 mm. long and as long as the triangular bracts. Peduncles axillary, slender, 5-7 cm. long, shorter than the leaves, ascending as are the leaves, the floral rachis much shorter. Leaves about 1 dm. long or less, the petiole about half the whole, the rachis tapering but little. Leaflets 3-5 pairs, about oval-obovate, rounded, thick, flat, shortly cuneate below, about 1 cm. long, distant, silvery-hoary with flat, broad, rough, tapering and closely appressed hairs. Stipules deltoid, very small and green, 2-3 mm. long. Stems very many from the crown of the slender and erect root, rather stout for the plant, flexuous, the many internodes rarely 3 cm. long, prostrate, a few inches to 2 ft. long. Winter annuals. Whole plant hoary. In rocky gulches along creek beds, Indian Spring Charleston Mts. to the Mojave desert. Tropical.

223. *Astragalus Howellii* Gray Proc. Am. Acad. 15 46 (1879). Pods including stipe fully 3 cm. long, abruptly contracted at both ends and then tapering into a long tip and base, triangular-cordate in cross section to broadly deltoid, mostly as wide as high, shallow-sulcate dorsally, completely 2-celled, chaptaceous, with a flat and ensiform tip a little deformed, the ventral suture concave in the middle and convex a little above, raised and thickened and with a thin and slightly raised edge along the middle, the body finely reticulated, minutely woolly at first, half-narrowly-elliptical, becoming smooth, the beak 3-6 mm. long and straight, the stout stipe as long as to 3 times as long as calyx tube. Flowers dirty white, becoming yellowish, about 1 cm. long, several. Banner about 7 mm. long, oblong-oval, arched abruptly to $45-60^\circ$ from calyx tips, with sides reflexed, about 2 mm. longer than wings. Wings 2 mm. longer than keel, oblong-lanceolate, obtuse, arched to 45° , about 2 mm. wide. Keel very wide and blunt, about 4 mm. long and 3 mm. high, the tip only a little higher than the rest and rather truncate, erect and rounded sharply from near the base, not purple, with a minute out-turned beak at the end. Calyx tube about 4 mm. long and 3 mm. high, a little narrowed at base and acutish, and attached to the slender pedicel near the corner, oblique at tip, cleft deeper above and with broad sinuses, the teeth triangular and a little shorter than the tube, pubescent. Pedicels in fruit 2-3 mm. long, recurved, mostly longer than the minute bracts. Peduncles in the type longer than the leaves, strict and stout, about 1 dm. long, the fruiting rachis hardly half as long. Leaves 5-7 cm. long, the upper sessile, with 8-9 pairs of linear-elliptical leaflets nearly contiguous and obtuse and long-petiolulate and cuneate, at base. Stipules rather thick, about 7 mm. long. Stems ascending, weak, soft, slender, very many, branched below, from a woody root, about a foot high, with many internodes somewhat shorter than the leaves, very leafy. A very variable plant. In the lower Columbia Basin east of the Cascades. Lower Temperate life zone. Blooming in May.

Astragalus Howellii var. *misellus* (Watson Proc. Am. Acad. 21 449 (1886) as species). This differs from the type in the flowers being 5-8 mm. long, the peduncles 3-7 cm. long and shorter than the leaves and about half as long as the fruiting rachis, leaflets about 5 pairs, internodes much shorter than the leaves and with a congested habit somewhat caespitose. It is seemingly very distinct but the pods vary from acuminate at both ends and long-stipitate to almost sessile and abruptly triangular at both ends, it is then *A. drepanolo-*

bus var. *aberrans* Jones. The leaflets vary from 2 to 10 mm. long. Pasco Wash., Mitchell Oregon, and on the John Day and Bruno rivers Oregon. Howell, Cusick, Elmer. Lower and Middle Temperate life zones, mostly in more humid places than the type, and less pubescent.

229. *Astragalus Mulfordæ* Jones Cent. 8 18 (1898). Onix Rydberg. Pods very thin and 1-1.5 cm. long, 3-4 mm. wide and high, very slightly concave along the ventral suture in the middle only, convex at both ends, often much so, from triangular-acute to bluntly apiculate at both ends, the tip being in line with the dorsal suture, the body half-elliptical to broadly half-oval, 2-5 mm. high in extreme cases, abruptly slender stipitate and stipe about equaling the calyx tips to 3 times as long, minutely pubescent and finely reticulated, shallow sulcate dorsally, opening along both sutures to base, cross-section about deltoid, with concave sides. Flowers about as in *A. campestris*, short and arched, about 7 mm. long, dirty white and purple-tinged, many, in long racemes, ascending to reflexed. Banner waterlined, abruptly arched to erect or more just beyond teeth, deeply and broadly grooved to tip, the groove 1 mm. deep and 2 mm. wide, occupying all of the upper half of the banner, with sides reflexed about $\frac{1}{2}$ mm. wide below and not at all at tip, the banner appears nearly square as you look at it. Wings obliquely elliptical, nearly 2 mm. wide in the middle, 2 mm. shorter than banner, the right hand one folded over the end of keel, the other flaring and then both tips touch, both concave to keel and obscurely notched below tip, fully 2 mm. longer than keel and arched, white and waterlined. Keel very short and abruptly rounded to nearly a half circle, very blunt, slightly darker above. Calyx tube rather obliquely inserted at the base, not oblique at tip nor erect deeper above; teeth triangular and about half as long as tube. Pedicels slender, reflexed, about 2 mm. long in fruit and longer than the triangular bracts. Peduncles filiform, from 1-7 cm. long, much shorter than the rachis. Flowers loosely racemose and reflexed. Leaves 3-10 cm. long, rigid, with filiform and tapering rachis not divaricate, narrow, nearly sessile, with 6-12 pairs of linear scales gradually reduced to almost nothing at tip of rachis, and distant. Stipules hyaline, with green tips from a deltoid and uniform base, 2-5 mm. long, recurved. Stems round and green, caespitose, often a foot long, with slender internodes rarely 5 cm. long, from slender and woody underground branches of the slender and erect and very long root. Growing in deep sand on steep south slopes, Weiser Idaho. Lower edge of the Middle Temperate life zone.

230. *Astragalus Inyoensis* Sheldon in Coville Death Valley Rep. 86 (1893). Pods either half-oval or arcuate-oblong, the body about 1.5 cm. long and 4 mm. wide and high, arcuate, abruptly contracted into a linear beak 2-4 mm. long, slightly sulcate dorsally, often decidedly obcompressed when much arched, on a stout stipe about as long as calyx, nearly smooth, inclined to be colored. Flowers purple, nearly 1 cm. long, showy, straight. Banner abruptly arched at calyx tips to 90°, with sides reflexed 1 mm. wide, 1-2 mm. longer than keel. Wings obovate, 1-2 mm. wide, about as long as keel. Keel large and broad, about 4 mm. long and 3 mm. high, half-cuneate-obovate, the tip almost square and erect, light colored toward the base. Calyx tube not oblique, the triangular teeth one-third to one-half as long as tube. Pedicels very short in flower and shorter than the triangular bracts. Peduncles filiform, not tapering, about twice as long as the leaves, a little longer than the fruiting rachis, widely spreading. Leaves divaricate, rarely 3 cm. long, wide, the upper nearly sessile, the lower about half the petiole. Leaflets 6-8 pairs, elliptical, about 5 mm. long, rounded, nearly contiguous, asny with closely appressed and short hairs. Stipules rigid, triangular, green, reflexed, 3-4 mm. long. Internodes 1-3 times as long as leaves. Stems very sparsely leary and elongated, prostrate or widely spreading, with the habit of *A. Nuttallianus*, several from

the crown of a slender root, apparently winter annuals. Darwin Mesa near Keeler California. Lower Temperate life zone.

231. *Astragalus Nevinii* Watson Proc. Am. Acad. 21 412 (1886). Pods narrowly oblong and a little arcuate, the body about 1.5 cm. long and 4 mm. high and 2 mm. wide, smooth and closely reticulated, chartaceous, barely to triangular-acute at both ends, sharply sulcate to the middle, wholly 2-celled. Stipe about twice as long as calyx. Flowers rather wide, about 1 cm. long, light colored, rather capitate. Banner oblong, arched abruptly to 15° at calyx tips, 6-8 mm. long. Wings narrowly oblong, 2 mm. longer than keel, about 3 mm. shorter than banner, arched somewhat. Keel straight, with tip erect, triangular and 2 mm. high. Calyx broadly campanulate, about 3 mm. long, with the triangular teeth about half as long as tube, soon reflexed. Bracts very small and as long as the very stout pedicels. Peduncles about as long as the leaves, in fruit loosely spicate on the upper half or third. Leaves all petioled, about 1 dm. long, recurved. Leaflets 5-7 pairs. Plants a foot or two long. San Clemente Island, Nevin and Lyon.

232. *Astragalus Traskiæ* Eastwood Proc. Cal. Acad. 3 102 fig. (1897). *A. Nevinii* var. *Traskiæ* Jones. Pods almost exactly those of *A. Howellii* but more arcuate, arcuately half-elliptical-oblong, or obliquely narrowly oblong and rather abruptly narrowed to a triangular flat beak 3 mm. long which is in line with the ventral suture, the body fully 1.5 cm. long, 3 mm. high and 5 mm. wide, very shortly-triangular at base, broadly and rather shallow-sulcate dorsally, coriaceous, finely corrugated, short-woolly, completely 2-celled, apparently ascending, in close clusters, stipe as long as calyx and teeth. Flowers white, becoming yellowish, about 12 mm. long, ascending in a close head. Banner oval, about 8 mm. long, arched abruptly to 45° at end of teeth, with sides reflexed 1 mm. wide below, 2-3 mm. longer than wings. Wings broadly linear, about 1 mm. wide and 1 mm. longer than keel, arched a little. Keel obliquely oblong, about 4 mm. long and 2 mm. wide, the tip nearly erect and rounded and a little darker. Calyx tube narrowly campanulate, about 4-6 mm. long and 2.5 mm. high, rounded at base and equally inserted on a very thick pedicel, cleft a little deeper above, not oblique, the triangular teeth one-fourth to one-third as long as tube, nigrescent. Pedicels and bracts minute. Peduncles nearly 1 dm. long, floral rachis 2-3 cm. long. Leaves rarely 1 dm. long, narrow, tapering, (*Nevinii* not noticeably so), with 8-10 pairs of leaflets 3-7 mm. long. Stems thick, forming broad mats 1-3 ft. long, with innumerable old leaf petioles forming a dense mass below. On cliffs in high and dry places, San Nicholas Island. Blanche Trask. This can probably be kept apart from *A. Nevinii* on the pod character and larger flowers, but the plants are suspiciously alike. This group is the representative of *A. Howellii* in the south.

233. *Astragalus Arthuri* Jones Cont. 8 20 (1898). *Atelophragma* Rydberg. Pods gladiate, about like those of *Brassica alba* but narrower, at tip the dorsal suture is nearly straight and the ventral narrowed to it, at base the opposite is true, sulcate dorsally with a narrow groove, chartaceous, nearly smooth, mature pods laterally flattened with concave sides, fully 2-celled, cross section triangular-cordate, ventral suture the more arched, thick at base and prominent externally. Flowers reflexed, white, like those of *A. stenophyllus*, about 1.2 cm. long. Banner about 1 cm. long, ovate, arched at calyx tips to nearly a half circle in gentle curve, the narrow tip much reflexed, about 4 mm. longer than wings. Wings narrowly oblong, about 2 mm. wide, arched to 30°, about 3 mm. longer than keel. Keel arched nearly from base to tip in a half circle, 4-5 mm. long and high, the tip triangular, acute a little more than erect, not dark. Calyx tube nigrescent, thin, thickened at lower corner where it is inserted on pedicel, short-cylindric, hyaline, 4 mm. long; a little oblique below but not at mouth, teeth sub-

late, 2 mm. long. Pedicels 2 mm. long, rather stout, spreading in flower and reflexed in fruit, nigrescent. Bracts subulate, 2-3 mm. long. Peduncles coarsely sulcate, about as thick as the stems, erect, 1 ft. long, few-flowered on the upper one-third. Leaves 1 cm. long, appressed, mostly clustered at tip of stems by shortening of upper internodes; petioles slender, 1-2.5 cm. long. Leaflets 10-14 pairs, elliptical-oblong, obtuse to retuse, 1 cm. long, 2-3 mm. wide, long-petiolulate, opposite, gradually reduced above the middle of the rachis, flat, somewhat distant. Stipules triangular, adnate, not connate, about 2 mm. long. Stems many, rather slender, ascending from crown of root, coarsely sulcate, abruptly bent at each node from which a peduncle arises, proper stems of few nodes which are close together, then with 2-3 which are 3-7 cm. apart; root stout and erect; plants about a foot and a half high. Lake Waha Nez Perce Co. Idaho by A. A. Heller for whom it was named. Middle Temperate life zone. Blooms in June.

LEPTOCARPI. 28.

Weak annuals. Flowers rarely 1 cm. long, mostly very small, in heads (rarely in few-flowered racemes). Pods papery, not inflated, linear (narrowly oblong in *A. Wrightii*) and falcate below (straight in *A. Wrightii* and nearly so in *A. leptocarpus*), sulcate dorsally, sharply acute (obtuse in *A. Francisquitensis*), sessile (stipitate in *A. Lindheimeri*), mostly horizontal (nearly erect in *A. Wrightii*), never closely reflexed, 2-celled (partition rarely incomplete). Stipules not connate.

KEY.

A. Flowers few and racemose at least in fruit, with blunt or barely acute keel not at all produced, purple-tipped; peduncles filiform. Pods smooth. Plants of the Tropical life zone (*A. Nuttallianus* extends also into the Lower Temperate life zone), nearly smooth throughout when mature.

AB. Pods about 1 cm. long, nearly smooth.

Very slender plants.

234 *Francisquitensis*.

A2B. Pods at least 2.5 cm. long, arched most below when curved, mostly more than 2 mm. high, narrowed at both ends, and apparently stipitate in *A. Lindheimeri*. Flowers 1-1.5 cm. long. Banner deeply notched, white spot large and purple-veined, wings white. Peduncles axillary and long. Leaflets 7-8 pairs, broadly elliptical to obovate, notched, thin. Bracts subulate. Stems not conspicuously sulcate, growing in dense vegetation and seemingly erect but weak and sprawling when not supported. Plants of the southeastern part of the great plains, nearly smooth when mature.

Pods 5mm. high.

235 *Lindheimeri*.

Pods 2 mm. high.

236 *leptocarpus*.

2A. Flowers in heads, purple or purple-tipped. Keel not acuminate nor sharp. Pods equally arched or nearly straight, 1.5-4 cm. long, linear or nearly so. Peduncles filiform, not over 5 cm. long, axillary. Plants slender but mostly erect.

2AB. Plants of the Californian plains. Pods not shaggy, on reflexed pedicels but with tips often erect, stipitate or tapering at base, nearly smooth at maturity, taper-pointed, not fully 2-celled, dorsally sulcate, nearly circular to reniform in cross-section, inclined to be obcompressed. Flowers 7-12 mm. long. Calyx tube about 2 mm. long, campanulate, nigrescent, reflexed to horizontal in fruit, with teeth triangular to subulate and rather shorter than the tube. Bracts and pedicels short. Heads of flowers not elongating in fruit. Petioles all evident except on the uppermost leaves. Stems $\frac{1}{2}$ to 2 feet high, rather widely branched below.

Pods 1-2 cm. long.

237 *tener*.

Pods 3-4 cm. long.

238 *Rattani*.

2A2B. Plants of the Texan plains. Pods shaggy, straight, erect, or only spreading about 1 cm. long, broadly linear to narrowly-oblong. Calyx tube very short and lobes very long and green. Whole plant appressed-shaggy.

Pods in heads.

239 *Wrightii*.

3A. Flowers few and inclined to be racemose, with sharp keel (keel sometimes obtuse in *A. Nuttallianus*) and wings inclined to be lobed. Pods linear.

3AB. Pods arched most near base, the tip mostly erect. Flowers single to few at or near the tip of the peduncle and inclined to be clustered, spreading.

Pods single or few.

240 *Nuttallianus*.

3A2B. Pods equally but not greatly arched, broadly linear, 1.5-2 cm. long, mostly inverted on a twisted pedicel, taper-pointed, laterally flattened, somewhat narrowed below, racemose and rather distant, ventral suture a fine rib, cross section narrowly triangular-cordate. Peduncles conspicuously longer than the short leaves. Leaflets broad and notched. Keel abruptly narrowed to a subulate beak at the upper corner. Wings lobed or broader above. Plants about as well placed in *Oxytropis* as in *Astragalus*.

Internodes few and long.

241 *acutirostris*.

Internodes not few, short.

242 *nothoxys*.

234. *Astragalus Francisquitensis* Jones Cont. 7 666 (1895).

Pods linear-oblong, nearly straight, about 12 mm. long, 2-3 mm. wide, obtuse, laterally flattened, chartaceous, with only a dorsal groove. Flowers 10-15 or less, in short raceme-like head or cluster, ascending, about 1 cm. long, narrow. Banner 5 mm. long, oblong, narrow, ascending 45° beyond calyx tips, with sides reflexed about 1 mm. wide. Wings linear, straight, 1 mm. wide, as long as banner and 3 mm. longer than keel. Keel short, very obtuse and rounded. Calyx tube hyaline, nigrescent, narrowly campanulate, about 3 mm. long, rather obliquely attached, barely 2 mm. high, the subulate teeth half as long as tube. Bracts triangular, 2 mm. long, hyaline. Pedicels slender, 1 mm. long, as long as bracts in fruit. Peduncles nearly 1.5 dm. long, strict. Leaves about 1 dm. long, with petioles 1.5-2 cm. long, but very short on the upper leaves. Leaflets 8-12 pairs, oblong-ovate to elliptical, finely petiolulate, 1-1.2 cm. long, about 7 mm. wide. Stipules 4 mm. long, reflexed, green. Stems many, filiform, delicate and long, rather flexuous, nearly prostrate, with internodes 4-7 cm. long. San Francisquito Lower California Brandegee.

***Astragalus Francisquitensis* var. *Lagunensis* Jones Cont. 8 11 (1898) and Cont. 10 61 (1902).** Like the type but pods deeply sulcate, with cross section triangular-cordate and tip pungently acute with point 1 mm. long. Flowers the same. Leaves 2-5 cm. long. Leaflets 7-8 pairs, narrowly elliptical, 4 mm. long, 2 mm. wide, rounded at both ends and shortly petiolulate. Internodes about 2.5 cm. long. Sierra de Laguna, Lower California, blooming in January.

235. *Astragalus Lindheimeri* Gray Pl. Wright 1 52 (1852).

A. recticarpus Wood. *Hamosa* Rydberg. *Tragacantha* Kuntze. Pods much like those of *A. succumbens*, 2.5-4 cm. long, about 5 mm. high, 1 mm. wide, contracted at base into a pseudo-stipe or nearly sessile, the triangular tip about in the middle of the end and ventral suture convex below it and then concave to the base, 2-celled at least to the middle, narrowly sulcate dorsally, ventral suture raised and forming a strong rib, with cross section Y-shaped, nearly erect at tip but pedicel horizontal or reflexed. Flowers 4-12, congested, about 12 mm. long. Banner nearly round, about 1 cm. long, purple-edged for 2 mm. in width, arched in gentle curve to 10-20° beyond calyx. Wings oblong, a little arched, rounded and blunt, 2-3 mm. wide, 2 mm. longer than keel and about 1-2 mm. shorter than banner. Keel purple-tipped, about 8 mm. long, then abruptly erect and tip deltoid and 4 mm. high. Calyx tube nearly hemispherical, about 2 mm. long, rounded at base and about equally inserted, a little oblique at tip, with thread-like teeth very lax and about twice

as long as tube. Bracts rather longer than the pedicels which are about 2 mm. long in fruit. Peduncles 2-3 cm. long and spreading. Leaves 4-7 cm. long, nearly sessile, spreading. Leaflets 6-8 pairs, narrowly-oblong-cuneate, contiguous, rarely 1 cm. long, ashy with minute pubescence. Stipules scarious, the upper green, broad at base, subulate. Stems many, relatively rather stout, diffuse, much branched. Plains of western Texas to Monterey, Mexico.

236. *Astragalus leptocarpus* T. & G. Fl. 1 354 (1838). *Hamosa* Rydberg. *Hamosa maculenta* Small. Pods rather obcompressed 2-celled except at tip, indifferently spreading but mostly ascending, about 2 mm. high and 2-3 mm. wide, 2-3 cm. long, nearly straight, shallow-sulcate dorsally, smooth, narrowly linear, triangular-acute and point in line with ventral suture. Flowers 3-7, closely clustered in flower, a little racemose in fruit, about 1 cm. long, purplish. Banner broadly obovate, with narrow furrow down the back, about 6 mm. long, arched abruptly at calyx tips to nearly erect. Wings obovate to oblanceolate, arched, about 2 mm. shorter than banner and 1 mm. longer than keel. Keel about 4 mm. long and high, the base straight and then abruptly erect and tip acutish and out-turned a little. Calyx tube campanulate, equally inserted, rather oblique at tip, about 2 mm. long, sometimes somewhat nigrescent, teeth triangular, mostly a little shorter than tube, not longer. Bracts 2 mm. long, about as long as fruiting pedicels. Peduncles 3-10 cm. long. Leaves 3-7 cm. long, short-petioled. Leaflets hardly contiguous, 4-10 mm. long, 2-4 mm. wide, cuneate-obovate to narrowly oblong, 5-10 pairs. Stipules about 4 mm. long, thin, subulate. Stems delicate and widely branched below, flexuous, with internodes 2-5 cm. long. This appears to hybridize with *A. Nuttallianus*. Nearly throughout Texas and southward to Central Mexico. Tropical.

237. *Astragalus tener* Gray Proc. Am. Acad. 6 206 (1864). *A. hypoglottis* var. *strigosus* Kellogg. Pods nigrescent when young, nearly straight in the type, rigid, 1-2 cm. long, about 3 mm. wide and high, nearly smooth when ripe, short-pointed, broadly sulcate dorsally, inclined to be bisulcate above along the ventral suture, round to obcompressed in cross section. Flowers 4-9, purple-tipped, 5-7 mm. long. Banner oblong, 3-4 mm. long, abruptly arched at calyx tips to erect, with sides reflexed, about twice as long as keel, and 1-2 mm. longer than wings. Wings broadly linear, rather arched, about 1 mm. wide. Keel narrow but arched from near the base to over a half circle, about 1 mm. wide, the deltoid tip about 1.5 mm. high. Calyx tube from turbinate to campanulate, acute at base, about 1 mm. long, the triangular teeth as long as tube to a half shorter. Bracts white, rather ovate, about 1 mm. long. Pedicels almost none. Peduncles spreading, 3-4 cm. long, shorter than leaves. Leaves 3-5 cm. long when mature, the lower ones about half petiole, numerous. Leaflets 4-7 pairs, linear to cuneate-linear, notched in the type. Stipules small, triangular, scarious. Stems nearly filiform, a foot or less high. Pubescence sparse and minute. In valleys from the Sacramento valley to San Diego, blooming in April or soon after rains. A very variable species.

Astragalus tener var. *Brucae*, n. var. Pods falcate, about 2 cm. long and 4 mm. high, rather papery, broadly linear, triangular pointed, conspicuously flattened laterally, shortly taper-pointed with flat tip, mottled, narrowly sulcate dorsally and not at all ventrally, erect. Flowers few. Calyx tube 2 mm. long, the teeth half the tube. Leaflets, 3-4 pairs, cuneate-obovate to almost deltoid, obcordate, all the petioles half the leaf. Stems prostrate. Stipules very broad for the plant and conspicuous, 2-3 mm. long, sometimes almost round. No. 2430 Mrs. Bruce, plains of Butte Co., blooming in March.

Astragalus tener var. *Rattanoides* n. var. Flowers and pods rather many in dense heads, reflexed, the pods about 1.5 cm. long, triquetrous, acuminate, arched to one-third circle, rigid, not mottled,

about 2 mm. high, a little laterally flattened, barely grooved below, obscurely bisulcate above. Leaflets narrowly linear and acute, about 7 pairs, about 1 cm. long. Stems many, erect or ascending. Upper leaves sessile. Quite a peculiar plant but evidently an offshoot of *A. tener*. Mt. Eden California, Brandegee, April 27, 1890.

238. *Astragalus Rattani* Gray Proc. Am. Acad. 19 75 (1883).
A. pauperculus Greene. Pods very narrowly linear to almost filiform, 3-4 cm. long, rarely 2 mm. high, laterally flattened and triquetrous, long-acuminate to a fine and straight point, narrowed below and empty and seemingly thick-stipitate, straight or equally arched to a half circle, or some pods bent near the base, shallow sulcate dorsally, not at all ventrally but suture raised and rib-like, with cross section narrowly triangular-cordate to almost round, the tip generally erect but flowers inclined to be reflexed. Flowers about 1 cm. long but variable. Banner oval, about 8 mm. long, deeply notched, arched abruptly at end of calyx to 45°, with sides reflexed 1 mm. wide in the middle. Wings half-rhomboidal, about the shape of the keel but tapering toward the tip, about 1-2 mm. longer than keel and 3-4 mm. shorter than banner, nearly white. Keel with straight base, about 5 mm. long, then abruptly erect, about 2 mm. high, the tip deltoid and 3 mm. high. Calyx rounded at base and equally inserted, oblique and cleft deeper above with rounded sinuses, the teeth triangular and about one-third the tube. The flowers vary a half in size, are often white or only purple-tipped and with conspicuous parallel-veined white spot, making the heads seem as if white banded, the wings vary greatly, often being obliquely oblong. Bracts hyaline, about 1 mm. long, equaling the pedicels. Peduncles 2-5 cm. long, spreading, longer than the leaves, with dense heads. Leaves lax and thin, 2-3 cm. long, short-petioled, spreading, with 4-5 pairs of linear-cuneate and notched leaflets nearly smooth. Stipules small and triangular. Stems almost filiform, straggling over weeds or flat on the ground. From Mendocino Co. southward through the Sacramento valley. Tropical. It is very doubtful whether this is distinct from *A. tener*.

239. *Astragalus Wrightii* Gray Pl. Lindh. 2 176 (1850). Pods 3-4 mm. high, laterally flattened, slightly sulcate dorsally, with partition intruded to the middle, very blunt and rounded at base and with triangular acute tip about in line with the dorsal suture which is straight, the ventral suture convex and pod seemingly up-side-down, cross section triquetrous-cordate. Flowers 4-5 mm. long, erect in dense heads, much as in *A. lotiflorus*. Banner oval, little arched, 3-4 mm. long, hardly surpassing the calyx lobes. Wings oblong, about as long as keel and a little shorter than banner. Keel with straight base and erect short tip. Calyx tube rather turbinate, hardly 1 mm. long, cleft nearly to the base with sharp sinuses, the lobes linear and acute, 3-4 mm. long and erect, about half as long as pods. Bracts like the calyx lobes and as long. Pedicels about 1 mm. long. Peduncles 3-5 cm. long, strict, in the upper axils, longer than the leaves, becoming stout. Leaves 2-4 cm. long, the upper sessile, the lower half petiole, ascending. Leaflets 3-5 pairs, rarely 1 cm. long, narrowly to broadly elliptical, acute at both ends at least on upper leaves. Stipules conspicuous, triangular, green, 3-5 mm. long, erect. Stems erect, inclined to be flexuous and simple, though often branched, a foot or less high, with slender internodes shorter than the leaves. The plant has the habit and appearance of a *Dalea*. It grows in rather open, dry or stony places in central Texas. Tropical. It has somewhat the appearance of *A. sesamus*.

240. *Astragalus Nuttallianus* DC. Prod. 2 289 (1825). *A. micranthus* Nutt. *Hamosa* Rydberg. *A. Nuttallianus* var. *canescens* T. & G. *Hamosa austrina* Small. Pods 2-3 cm. long, not over 3 mm. high or wide, slightly sulcate dorsally, pubescent except when fully ripe at times, mostly much laterally flattened, barely narrowed be-

low, triangular-apiculate. Flowers pale or purple-tipped, arched. Banner rather obcordate, a little longer than keel and equaled by the wings or oval and 2 mm. longer than wings. Wings obovate, about as long as keel or a little more, entire. Keel with straight base, then rounded to erect or a little more, the tip either triangular-acuminate or deltoid or rarely obtuse, erect, 2-4 mm. high. Calyx tube acute at base, not gibbous, 1-2 mm. long, the teeth subulate-unequal, and as long. Bracts ovate, minute; pedicels very short. Peduncles very short to 3 times as long as leaves, filiform. Leaves sparse, all petioled, 2-5 cm. long. Leaflets in the type about 5 pairs and oval to elliptical, rounded, rarely acutish, mostly notched, contiguous, rather smooth above, usually about 7 mm. long, rarely 1 cm. or 2 mm. long. Stipules lanceolate. Delicate and filiform stemmed plants from a few inches to 2 ft. long, freely branched below, prostrate. Common from the Pacific coast to the Plains of Colorado throughout the Great Basin and southward to central Mexico, on sandy plains. Lower Temperate and Tropical life zone. Blooming throughout the season, sometimes a winter annual. *A. subuniflorus*, Greene, is probably the same.

Astragalus Nuttallianus var. *trichocarpus* T. & G. Fl. 1 334 (1838). *A. trichocarpus* (T. & G.) Young. This differs from the type in having the whole plant even to the pods villous with spreading hairs. Low annual mostly. Peduncles short. Leaflets 5-7 pairs, at least obtuse. Flowers about 4 mm. long. Keel much shorter than the banner, tip incurved and acute to obtuse, the annual forms have decidedly pointed keel. This is more common in Texas and New Mexico.

Astragalus Nuttallianus var. *enneajugus* Jones Cont. 8 22 (1898). Pods arched most below, 2 cm. long, 2.5 mm. high, much flattened laterally, smooth, ascending. Flowers several, about 7 mm. long, in a head in both flower and fruit. Calyx tube 1.5 mm. long, teeth filiform-subulate, nearly double the tube. Peduncles shorter than the leaves in fruit or longer in flower. Leaflets at least on the upper leaves 9-10 pairs, oblong, emarginate, not over 1.5 cm. long. Robust plants, leafy, 1-1½ ft. high. Stipules conspicuous, 4 mm. long, adnate. Texan prairies.

Astragalus Nuttallianus var. *quadrilateralis* Jones Cont. 8 22 (1898). Pods congested at tips of peduncles, smooth, gently arcuate, 2 mm. high, 2.5 cm. long, quadrilateral, shallow-sulcate at both sutures, sides rather concave, tip ascending and sharply acute. Flowers 3-6. Peduncles longer than the leaves to twice as long in fruit, 5-10 cm. long. Leaflets 6-7 pairs, oblong, emarginate, not over 1 cm. long. Plants rather stout and with large leaves, erect, annual, 1 ft. high. Arkansas and Oklahoma.

Astragalus Nuttallianus var. *leptocarpoides* Jones Cont. 8 22 (1898). Pods few, widely spreading, equally arched, not over 1.5 mm. high, 2.5-3 cm. long, somewhat flattened laterally, smooth, ventral suture not depressed, cross section triangular, tip barely acute, apiculate. Flowers rather large, 7-10 mm. long. Calyx lobes barely as long as tube. Peduncles longer than the leaves, 5-8 cm. long and slender. Leaflets about 8 pairs, 5-10 mm. long, emarginate, oblong-elliptical. Widely spreading to prostrate and slender plants. Seeds many. Prairies, Galveston Island, Texas.

Astragalus Nuttallianus var. *Cedrosensis* (V. & R. Cont. Nat. Herb. 1 15 (1893) as species). *A. portensis* Greene. A starved form with about 3 pairs of deltoid-cuneate leaflets 2-4 mm. long and notched. Flowers 1-3. Calyx hemispherical. Pods 10-12 mm. long, narrowly oblong, equally arched, acute, 2 mm. high, smooth. Cedros Island Lower California, Palmer, No. 692.

241. *Astragalus acutirostris* Watson Proc. Am. Acad. 20 360 (1885). *A. streptopus* Greene. *Oxytropis* Jones. *Aragallus* Heller. Pods almost completely 2-celled, acute at both ends and almost stipitate, becoming smooth with age, horizontal or a little reflexed.

Flowers 3-7, remote, whitish or purple-tipped, 4-6 mm. long. Banner oval, arched abruptly at calyx tips to nearly erect, 3-4 mm. long, a little longer than wings. Wings lobed or enlarged at the end, obovate, about as long as keel. Keel with an acute and ascending beak but variable. Calyx tube short-campanulate, 1-2 mm. long, the slender and lax teeth as long as tube. Bracts and pedicels minute. Peduncles 4-10 cm. long, somewhat longer than the widely spreading leaves, in the upper axils. Upper petioles short, the lower 1-2 cm. long. Leaflets 5-7 pairs, broadly oblong-obovate, folded, 4-10 mm. long, very short-petiolate, thickish and puberulent. Stipules deltoid and very small. Stems diffusely branched below, with the habit of *A. Nuttallianus*, a foot or two long. Internodes few and long. On the hot plains from Hawthorne Nevada to Mexico along the eastern face of the Sierras and southeastward to the Charleston Mts. Tropical.

242. *Astragalus nothoxys* Gray Proc. Am. Acad. 6 232 (1864).
Oxytropis Jones. *Aragallus* Heller. Pods pungently acute, scarcely contracted below, 2-3 mm. high, nearly 2-celled, smooth or nearly so, sulcate to the middle dorsally, nearly erect. Flowers white and purple-tipped, 8-10 mm. long. Banner oblong, 5-7 mm. long, abruptly arched at calyx tips to 80°, with sides reflexed about 1 mm. wide below. Wings linear below and with enlarged, rounded and obovate tip, 2-4 mm. longer than keel. Keel with arcuate tip 2 mm. high, exerted not over 2 mm. beyond calyx tips, the body about 3 mm. long and 1 mm. high. Tipped with a threadlike beak. Calyx tube narrowly campanulate, 3-4 mm. long, with straight base and arched upper side, 1-2 mm. high, cleft deeper above, oblique and thickened at base. The subulate teeth unequal and about half the tube. Pedicels 2-3 mm. long in fruit, slender, about twice the ovate bracts. Peduncles 5-15 cm. long, appearing as if subscapiform, axillary, rachis several flowered and rather short. Leaf petioles from 2.5 cm. long to none. Leaflets oval-obovate, mostly notched, thick, mostly flat and appearing as if glaucous, with the pubescence minute, about 6 pairs, 4-7 mm. long. Stipules subulate, green, 2-4 mm. long. Internodes short and plants very leafy, stems a foot or less long, very many and branched below, decumbent at base. Whole plant nearly smooth. Catalina Mts. Arizona. Tropical. Puerta de St. Diego Chihuahua Mexico, Lumholtz. Blooming in April.

MICRANTHI. 29.

Flowers very small, mostly 3-8 mm. long (12-15 mm. long in the Pringlei group, in Madrensis and ervoides), in heads, or spikes, or rarely in short racemes, nearly always reflexed. Calyx about campanulate, 1-3 mm. long. Pedicels very short. Bracts small. Pods oblong to linear, little arched but always oblique, small, 4-12 mm. long, 2-celled (imperfectly so in Purpusi), triquetrous to reniform in cross section, not inflated or but little so, papery to chartaceous, sessile or minutely stipitate (stipitate in A. Purpusi), rounded to notched at base, sharply acute (merely apiculate in Seatonii), sulcate dorsally, ventral suture raised and thickened. Woody rooted perennials (possibly annual in A. Pringlei) with slender stems, either short and caespitose or long and widely spreading, rarely erect. The Mexican species of this group are poorly known and arrangement and species are only tentative.

KEY.

A. Flowers few and in racemes.

AB. Pods much laterally flattened, with ventral suture the more arched and tip conspicuously declined, nearly oval, 4-5 mm. long.

Pods woolly, covered by the leaves.

243 lentiformis.

A2B. Pods very broad or obcompressed in cross section, oblong to linear, arcuate, about 1-1.5 cm. long. Flowers purple-tipped, broad. Calyx campanulate. Peduncles slender, 5-10 cm. long. Leaflets elliptical, rounded or barely acute. Stems slender from a woody root. Stipules small.

Pedicels evident.

Foliage ashy.

244 Madrensis.

Foliage nearly smooth.

245 ervoides.

Pedicels almost none.

Pods 1-2 cm. long.

246 Greggii.

Pods 7-10 mm. long.

247 Luisianus.

2A. Flowers in heads.

2AB. Flowers and pods reflexed in dense heads at the ends of filiform peduncles. Calyx turbinate-campanulate, the tube about 1 mm. long. Flowers 4-5 mm. long, broad. Pods about 8 mm. long and 2 mm. high, laterally flattened, very obtuse.

Internodes elongated and stems almost filiform.

248 Pueblæ.

2A2B. Flowers ascending, few, in loose heads. Calyx campanulate. Pods apiculate or very short-pointed, not reflexed. Flowers narrow, 7-12 mm. long. Banner oblong-ovate. Wings about 1 mm. wide. Calyx tube about 3 mm. long. Pubescence ashy and minute.

Pods oblong, 7-10 mm. long.

249 Pringlei.

Pods linear, about 1 cm. long.

250 parvus.

Pods linear-oblong, 1 cm. long, 3 mm. high, 4 mm. wide. 251 Schaffneri.

2A3B. Flowers broad, rather many in dense heads, rarely 10 mm. long. Calyx campanulate, 1-3 mm. long. Peduncles axillary. Stems decumbent or prostrate.

2A3BC. Leaflets about 1 cm. long, appearing narrow. Flowers white, 4-7 mm. long (8-10 mm. long in *A. Esperanzæ*). Peduncles shorter than the leaves, slender. Calyx equally inserted, not oblique, nearly hemispherical. Leaves spreading. Leaflets folded. Stems slender, with many leaves and short internodes.

Peduncles shorter than the leaves. Pods about 7 mm. long
252 Lemmoni.

Peduncles not shorter than the leaves. Pods about 1 cm. long.

Stipules -connate, large. 253 *Esperanzæ*.

Stipules free and small. 254 *Chapalanus*.

2A3B2C. Leaflets broad, about 5 mm. long. Flowers purple-tipped, about 5 mm. long. Peduncles filiform, much longer than the leaves. Stems prostrate and short.

Peduncles much longer than the leaves. Pods linear-oblong,
1 cm. long. 255 *hypoxylus*.

2A3B3C. Leaflets 3-5 mm. long. Flowers purple 4-5 mm. long. Peduncles filiform, about as long as leaves. Calyx turbinate-campanulate, 1 mm. long, the teeth shorter than the tube. Stems slender, 2-4 dm. long.

A. Purpusi might be sought here, but has a stipitate pod.

3A. Flowers very many, in spikes which are mostly dense but sometimes linear, elongated and loose. The plants of this group are mostly Mexican and the specific limitations are merely tentative till the species are better known.

3AB. Pods sessile (minutely stipitate in *A. Hartwegi*, *Saltonis* and *Seatoni*) rigid, reflexed, 1-1.5 cm. long, linear, triangular-acute, a little arched.

3ABC. Pubescence fine and attached by the base.

3ABCD. Flowers about 8 mm. long. Pods loosely pubescent and rather nigrescent.

Pods reniform in cross-section and loosely pubescent. 256 *Hartwegi*.

Pods triquetrous-cordate and smooth. 257 *militaris*.

Pods deltoid in cross-section and nigrescent. 258 *Saltonis*.

3ABC2D. Flowers about 4 mm. long, very densely clustered. Pods closely reflexed, linear-lanceolate, acuminate, sharply arcuate below, about 1 cm. long, 1-1.5 mm. high and 1.5-2 mm. wide. Leaflets nearly linear.

Pods pubescent. Flowers short and stubby. 259 *vaccarum*.

3AB2C. Pubescence very fine and attached by the middle. Plants silvery-silky. Stipules large, hyaline and connate. Stems procumbent.

Pods linear and closely reflexed. 260 *hypoleucus*.

3A2B. Pods not linear, ovate to oval, but little longer than calyx, not over 7 mm. long, closely reflexed in narrow spikes. Flowers small or minute.

3A2BC. Pods in short spikes. Peduncles filiform. Stipules triangular, not connate.

Pods 7 mm long, smooth. 261 *oxyrhynchus*.

Pods 4 mm. long, nigrescent. 262 *Seatoni*.

3A2B2C. Pods in long and linear spikes. Flowers white, wide. Calyx about 2 mm. long. Leaflets 8-10 pairs. Stipules not connate.

Pods ashy. 263 *Goldmani*.

Pod smooth. 264 *Clevelandi*.

4A. Pods in heads and on slender stipes nearly as long as calyx. Flowers minute.

Pods reflexed and pubescent.

265 Purpus.

243. *Astragalus lentiformis* Gray Bot. Cal. 1 156 (1876).

Pods broadly oblong, 3 times the calyx, chartaceous, not wrinkled, very slightly sulcate dorsally, normally reflexed though sometimes ascending, completely 2-celled, woolly-pubescent, both sutures prominent externally. Cross-section narrowly to broadly ovate-cordate, partition very broad. Flowers white like those of *A. Lemmoni*, about 5 mm. long. Banner broadly elliptical, 3-4 mm. long, arched abruptly to 60° at the end of calyx tube, 2 mm. longer than the wings, sides reflexed. Wings lanceolate, arched and concealing keel, obtuse. Keel rounded from the base to the tip into almost half a circle, barely exceeding the calyx teeth, with short blunt and erect tip. Calyx tube woolly, Hedeoma-like, hemispherical, arched, cleft deeper above, 2 mm. long, teeth rather shorter than the tube and the lower the longer. Pedicels almost none in flower, 1 mm. long in fruit. Bracts hyaline, ovate-acuminate, 2 mm. long. Peduncles 7-15 mm. long, about half as long as the leaves, stout, seldom as long as the rather dense racemes. Leaves 2-4 cm. long. Petioles short. Leaflets 5-7 pairs, obovate to oblong-spatulate, retuse to emarginate, smoother above, 4-10 mm. long. Stipules not connate except below and larger there, adnate, 2-3 mm. long and rather large, ovate or the upper triangular. Stems prostrate, slender, barely grooved, much branched, a few inches long, flowering abundantly from all the nodes, internodes not over 2.5 cm. long. Pubescence fine, loosely villous, appressed, more or less hoary, with slender long and echinate hairs fixed by the base. Root erect, much branched. Middle Temperate life zone, growing in the sagebrush. Sierra Valley California to Crook Co. Oregon.

244. *Astragalus Madrensis* n. sp. Pods broadly to narrowly linear, 1-1.5 cm. long, about 2 mm. high and 1 mm. wide, somewhat laterally flattened except at base, abruptly apiculate to shortly-acuminate, narrowly-sulcate dorsally, strongly reflexed. Flowers few, about 1 cm. long, reflexed. Banner oval and striped with purple, abruptly erect at calyx tips and with sides reflexed below, about 5 mm. long. Wings obovate and veined, about as long as banner and 4 mm. longer than keel, nearly straight. Keel about 3 mm. long and high, deltoid and obtuse. Calyx about 3 mm. long and 2 mm. high, with straight base and convex upper side, nearly truncate below and attached by the lower fleshy corner, not narrowed below, the triangular teeth a little shorter than the tube, ashy with fine and short hairs. Pedicels 2-3 mm. long and equaled by the triangular bracts. Peduncles about 5 cm. long, shorter than the leaves, axillary. Leaves about 1 dm. long, all short-petioled, many. Leaflets about 10 pairs, 5-10 mm. long, thickish, appearing as if glaucous but minutely ashy, not contiguous. Stems a foot or two long, decumbent, with very short internodes, rather stout, woody below and branched, with the habit of *A. bisulcatus*. Stipules subulate from a deltoid base, small. Rather common in the Sierra Madres of Chihuahua Mexico, San Diego Canon, Colonia Juarez, and Sabinal, Jones. Lower Temperate life zone, and probably Tropical also, growing in open places along creeks. Blooming in spring and fall.

245. *Astragalus ervoides*. H. & A. Bot. Beech 417 (1841).

A. apertus Sheldon, *A. Tepicus* Sheldon. Pods linear, smooth, acute. Flowers 10-12, about 12 mm. long, with petals about twice the calyx, white. Calyx broadly campanulate, about 3 mm. long, with short and black-hairy teeth and pedicels. Peduncles axillary, longer than the leaves. Leaflets 7-8 pairs, about 12 mm. long, linear-oblong and obtuse. Stipules lanceolate and small. Stems slender, widely spreading, about a foot long. Pubescence almost none. It is probable that this obscure plant from Tepic Mexico belongs here. But it is very poorly described.

246. *Astragalus Greggii* Watson Proc. Am. Acad. 17 343 (1882). Pods sessile, 1-2 cm. long, 2-3 mm. high, 1 mm. wide, broadly linear, reticulated, narrowly and shallow sulcate dorsally equally arcuate or arched most below, triangular-acute, smooth, laterally flattened, completely 2-celled, erect, inclined to be narrowed below and resembling *A. leptocarpus*. Flowers 6-9 mm. long, 2-4 in a head or short raceme, light-purple, much arched as in *A. junceus*. Banner round, 5 mm. long, abruptly erect. Wings obliquely obovate, 2 mm. shorter than banner. Keel arched in a half circle and 1-2 mm. shorter than the wings. Calyx woolly, oblique, with teeth subulate, unequal, curved and as long as tube. Bracts small, ovate. Pedicels almost none. Peduncles subterminal, slender, 3-7 cm. long. Leaves 2-5 cm. long. Leaflets 4-8 pairs, contiguous, greener above, obovate to oval or oblong, obtuse to notched, woolly to nearly smooth, 2-7 mm. long. Stipules connate below, triangular. Internodes 2-3 cm. long. Stems very slender, flexuous, about a foot long or more, prostrate to spreading, seemingly perennial from underground stems, dense and woolly and white on the stems and young parts, the hairs spreading or reflexed. This has the habit of *A. Nuttallianus* but pods are higher and the pubescence is woolly, also like *A. Lindheimeri* but with smaller pods and flowers and loose pubescence, the pods are about those of *A. leptocarpus*. In the mountains of Coahuila, Zacatecas and Nuevo Leon, Mexico, Tropical.

247. *Astragalus Luisanus* n. sp. Pods oblong-ovate to broadly linear, 7-10 mm. long, a little arcuate, 2-3 mm. high and wide, sometimes 5 mm. wide, rather obcompressed, nearly smooth when ripe, tapering into a sharp and upturned beak about 2 mm. long, sulcate dorsally. Flowers 5-7 mm. long, broad, few. Banner oval, about 4-7 mm. long, arched abruptly at calyx tips to erect, with sides reflexed about 1 mm. wide below. Wings broadly linear, to lanceolate, about straight and as long as banner, or arched to 45°, about 1 mm. wide and 2 mm. longer than keel. Keel about 4 mm. long and 3 mm. high, arched nearly from base to over a half circle, the very obtuse tip rather hooked. Calyx nigrescent, about equally inserted, about 2 mm. long, campanulate, teeth triangular and about as long as tube. Bracts hyaline, hairy, nearly as long as calyx tube. Pedicels almost none. Peduncles filiform, 5-7 cm. long. Leaves 3-4 cm. long, the upper sessile. Leaflets elliptical, obtuse to barely acute, silvery-silky with fine and closely appressed rather long hairs, 5-8 pairs. Stipules connate above, small. Stems slender, weak, a few inches long, from a woody base and stout root, rather densely leafy and with short internodes. Central Mexico, blooming in June, probably Middle Temperate life zone. The types are Purpus plants Nos. 3208 from near Oaxaca Mexico, and 2477 from Esperanza in the State of Puebla.

248. *Astragalus Pueblae* Jones Cont. 14 35 (1912). Pods broadly linear, about 1 mm. wide, a trifle wider above, thin, with cross section narrowly-cordate-triangular, deltoid-apiculate, rounded at both ends and very blunt, ashy, sulcate dorsally except at tip and base; ventral suture straight except at the convex tip and base, the point a little above the middle of the end, thickened but not raised. Flowers purple, broad. Banner white, broadly oblong and notched strongly, about 3.5 mm. long, with sides reflexed closely, arched to 45° at calyx tips and abruptly. Wings obliquely-ovate, large for the flower, about 1 mm. wide and 1 mm. longer than keel, purple-tipped. Keel a little declined, half-deltoid-ovate, about 2 mm. long, purple, the straight but not erect tip very broad and barely acute. Calyx teeth rather subulate, about half as long as tube, unequal, tube not oblique nor unequally inserted. Bracts minute and scarious. Pedicels filiform, about 2 mm. long. Peduncles nearly erect. Leaves 5-7 cm. long, ashy, lax, short-petioled, sparse. Leaflets 4-5 pairs, hardly 1 cm. long, linear and folded, distant. Stems nearly filiform, lax, many, branched, with the long

internodes nearly as long as the leaves, flexuous, prostrate or widely spreading. Stipules not connate, triangular, 2-3 mm. long. Root apparently perennial. Plants with the habit of *A. Nuttallianus*. Esperanza Puebla Mexico, Purpus, No. 5645. Probably Tropical.

249. *Astragalus Pringlei* Watson Proc. Am. Acad. 21 449 (1886). Pods oblong, 7-10 mm. long, about 3 mm. wide and 2 mm. high, abruptly and strongly apiculate, with ventral suture straight and in line with it, broadly sulcate dorsally, with cross section broadly and narrowly (vertically) reniform. Flowers white or purple-tipped, 8-12 mm. long, loose. Banner arched a little beyond the calyx tips, 2-3 mm. longer than wings, with sides reflexed below. Wings broadly linear, a little arched, 2 mm. longer than keel. Keel narrow, about 3 mm. long, gently arched from base to $45-90^\circ$, and with rounded and dark tip about 2 mm. high. Calyx tube 3-4 mm. long, about 2 mm. high, with straight base and convex upper side, oblique at base and acute and attached by the lower corner, not oblique at tip nor deeper cleft, teeth triangular and nearly half as long as tube. Pedicels slender, about 1 mm. long and about as long as the ovate bracts. Peduncles 2-3 cm. long, filiform, axillary. Leaves about 2 cm. long, nearly half is petiole. Leaflets 5-7 pairs, linear to obovate, obtuse, 2-3 mm. long, not contiguous, thick, ashy with minute and fine short hairs or greener above. Stems prostrate, only a few inches long, with short internodes. Stipules small, not connate. The flowers and pods are quite variable in size. Tropical, blooming in April. On the plains near Chihuahua City, Mexico.

250. *Astragalus parvus* Hemsley Bot. Cent. Am. 1 266 (1880). Pods linear, about 1 cm. long and hardly 2 mm. high, apiculate, spreading, sulcate narrowly along the dorsal suture which is straight, and the tip in line with it, the ventral suture convex. Flowers purple, about 7 mm. long. Banner about 5 mm. long, arched abruptly at calyx tips to $45-90^\circ$, with sides reflexed below, about 3 mm. longer than wings. Wings oblong, arched, about 1 mm. longer than keel. Keel with entire blade erect, 2 mm. long and high, the front rounded to over a half circle, very obtuse. Calyx tube about 2 mm. long, narrowed below, little oblique attached below the middle to a slender but minute pedicel, the triangular teeth about half as long as tube. Bracts minute. Peduncles 2-3 cm. long, longer than the leaves, subterminal. Leaves 3-5 cm. long, spreading, only the uppermost sessile. Leaflets 6-9 pairs, oblong, distant, obtuse, 2-4 mm. long, short-petiolate. Stipules very small, broad, green, not connate. Stems rather many from a thick root, decumbent, a few inches long, with short internodes. San Luis Potosi Mexico, Lower Temperate life zone, in open places.

251. *Astragalus Schaffneri* n. sp. Pods about 1 cm. long, 3 mm. high and 4 mm. wide, linear-oblong, a little arcuate, with the ventral suture concave and the somewhat declined tip in line with it, triangular-acute, broadly sulcate dorsally, with reniform cross section, indifferently spreading or reflexed. Flowers, pedicels and bracts as in *A. parvus*. Peduncles filiform, 3-6 cm. long. Stems nearly filiform, flexuous, widely spreading, freely branched below and open, from slender woody rootstocks, about a foot high, with internodes 2-3 cm. long, floriferous nearly throughout. Stipules subulate, conspicuous, spreading 3-4 mm. long. Leaves 3-4 cm. long, ascending, all but the lowest sessile. Leaflets 5-8 pairs, nearly 1 cm. long, distant, folded and seemingly linear but narrowly elliptical, long-petiolate, obtuse. No. 815 Schaffner from San Luis Potosi Mexico. This has been referred to *A. parvus* by Watson, but it appears to be quite a different plant. Lower Temperate life zone.

252. *Astragalus Lemmoni* Gray Proc. Am. Acad. 8 626 (1873). Pods half-oblong-ovate, about 7 mm. long, 2 mm. wide and 1.5 mm. high, with cordate cross section, almost straight (rarely a little arcuate) along the ventral suture and ending in a sharp mucro and triquetrous, shallow-sulcate dorsally, green or reddish,

ascending, ashy. Flowers 4-5 mm. long. Banner oval, about 3 mm. long, with sides reflexed about $\frac{1}{2}$ mm. wide below, abruptly erect at end of tube, waterlined, often seemingly fiddle-shaped; groove U-shaped and very broad and filling the whole banner above. Wings oblong, arched 30° , about 1 mm. wide, about as long as banner, or 2 mm. shorter, oblique and obtuse at tip, the right hand one incurved over keel, the other flaring, tips connivent, 2 mm. longer than keel. Keel half-oval-obovate, about 2 mm. long, obtuse. Calyx a little over 1 mm. long, reddish, with acutish base, ashy, rather shorter than the subulate and curved teeth, on a slender pedicel about 1 mm. long which equals the linear and thin bract. Peduncles axillary throughout, often twin, about 2 cm. long, filiform. Leaves 3-4 cm. long, wide, the upper ones sessile. Leaflets about 6 pairs, seemingly linear but narrowly to broadly elliptical, obtuse, rather thin, slender-petiolulate and rather cuneate at base, about 1 cm. long above, appearing green especially above but minutely pubescent. Stems 1-3 ft. long, prostrate in wide mats, many, simple above, freely branched below, straight, with internodes a little shorter than the leaves. Stipules triangular, green, about 4 mm. long, not connate. Root thick, rather fleshy and erect. Stems herbaceous to the very base. From Chat to Yreka California, growing on the sagebrush benches on the eastern edge of the Sierras. Middle Temperate life zone. This has the flowers and habit of *A. Pulsiferæ* and *debilis*.

253. *Astragalus Esperanzæ* n. sp. Pods about 1 cm. long, 3-4 mm. wide and 2 mm. high, oblong, nearly straight, the ventral suture a little concave, shortly triangular-acute at tip with a small flat mucro, obcompressed below, with cross section reniform, shining when ripe and finely cross-nerved, opening throughout at both sutures, reflexed, broadly sulcate dorsally to the middle. Flowers greenish-white or purple-tinged, becoming yellowish when dry, about 8-10 mm. long, about 10, spreading in a dense head. Banner oval, 5-7 mm. long, arched sharply to nearly erect at calyx tips, with sides reflexed 1 mm. wide below, about 1 mm. longer than wings, or about equaling them. Wings broadly linear, about 2 mm. wide, arched to 45° , 2 mm. longer than keel. Keel half-rhomboidal, about 3 mm. long and high, the base a little convex then abruptly bent to erect and tip broadly triangular and acutish, exceeding the calyx teeth by about 2 mm. Calyx tube about 2-3 mm. long, nigrescent, cleft deeper above, the triangular-subulate teeth about as long and straight. Pedicels almost none, bracts lanceolate, white, thin and about as long as calyx tube. Peduncles slender, about 5-15 cm. long, longer than the leaves, axillary above, single. Leaves 4-5 cm. long, broad, all short-petioled. Leaflets 8-12 pairs, linear to cuneate-linear, blunt, about 8-15 mm. long, ashy with very short and rough appressed hairs, not contiguous. Stipules conspicuously connate almost to the tips, rather hyaline, 5 mm. long. Stems several, mostly from underground branches of a stout root, flexuous, spreading, a few inches to 2 ft. long, with many internodes 1-5 cm. long, leafy. Esperanza Puebla Mexico, No. 3207 Purpus. In bloom in August, evidently the second flowering of the year. Lower Temperate life zone probably. Plateado Zacatecas Mexico, J. N. Rose Nat. Herb. No. 301689, Sept. 3, 1897; Tlalnepantla state of Mexico, July 6, 1905, J. N. Rose, Nat. Herb. No. 451904; Tulancingo state of Hidalgo, J. N. Rose, Nat. Herb. No. 452311; Alvarez San Luis Potosi, Palmer, July 13, 1904, Nat. Herb. No. 471072. The Purpus material in my herbarium is the type.

254. *Astragalus Chapalanus* n. sp. About as in *A. Esperanzæ* but stipules minute and subulate and not at all connate. Pods about 1.5 cm. long, obliquely lanceolate-oblong and a little arched, shortly acuminate, on stout peduncles 5-7 cm. long which about equal the leaves. Leaves about 5 cm. long, sessile, of about 10-12 pairs or subalternate leaflets which are nearly contiguous, broadly linear, long-petiolulate, shortly cuneate at base. Stems about a foot high,

flexuous, with internodes nearly as long as leaves, decumbent at base and with peduncles in the middle axils. Blooming evidently in July and fruiting in September and with peduncles in the upper axils, but the type gathered in October after the tops had a second growth from the fall rains after fruiting. Near Chapala Jalisco Mex., Oct. 5, 1903. J. N. Rose, Nat. Herb. No. 451239.

255. *Astragalus hypoxylus* Watson Proc. Am. Acad. 18 192 (1883). Pods about 1 cm. long and 3 mm. wide and high, obliquely and narrowly linear-oblong, with ventral suture about straight or a trifle concave, shortly acuminate into a triangular beak about 2 mm. long which is straight with the ventral suture, inclined to be a little laterally flattened, ascending, cross section cordate, rather narrowly sulcate dorsally, ashy. Banner about 3-4 mm. long, oval, abruptly erect at end of tube. Wings oblong, about as long as banner and 2 mm. longer than keel. Keel about 2 mm. long and high, erect and deltoid, acutish. Calyx tube turbinate, about 2 mm. long, tapering into the slender but very short pedicel, nigrescent, with subulate teeth as long as tube and lax. Bracts minute, about as long as pedicels. Peduncles about 5 cm. long, from the lower axils, twice as long as leaves. Leaves 2-3 cm. long, all short-petioled, spreading. Leaflets 4-6 pairs, oval-obovate and long-petiolulate, rounded, ashy with fine and appressed hairs. Stipules not connate, small, green, triangular. Stems loosely matted, a few inches long, with short internodes. Huachuca Mts. Arizona, Lemmon. Purpus's No. 2477 from Esperanza Puebla seems to be the same. Plants referred to this from Lower California seem different.

Astragalus Purpusi Jones might be sought here, but has a stipitate pod.

256. *Astragalus Hartwegi* Benth. Pl. Hartw. 10 (1839). Pods 2-3 mm. wide, about 2 mm. high, with reniform cross section, often a little sulcate ventrally as well as dorsally, appearing as if a trifle inflated, densely spicate and very closely reflexed, minutely stipitate. Flowers white or purple, closely reflexed. Banner nearly round, closely hugging the keel or abruptly arched to 45° beyond the calyx tips, rather thick and with sides barely reflexed around the margin, about 3 mm. long, about 1 mm. longer than wings. Wings linear, a little arched, about 1 mm. longer than keel. Keel with straight base and then abruptly erect, obtuse, the general outline falcate-obovate, about 2 mm. high. Calyx tube campanulate, about 2 mm. long, very oblique at both ends and attached on the lower corner, nigrescent, the deltoid teeth about half as long as tube. Fruiting pedicels hardly 1 mm. long and about as long as the hyaline bracts. Peduncles 5-20 cm. long, subterminal, rather stout, much longer than the leaves, rarely some lower ones short. Floral spikes shorter than the peduncles. Leaves rarely 5 cm. long, the upper sessile. Leaflets 5-9 pairs, not contiguous, narrowly oblong, obtuse, rather smooth above, 5-15 mm. long, cuneate at base, those of the lower leaves much reduced and often oval. Stipules not connate, lanceolate, rather large, green. Internodes shorter than the leaves. Stems slender ascending, a foot or two long, flexuous, branched below, from an erect and rather slender root. Pubescence short and closely appressed. Central Mexico, and northward probably to Chihuahua. Lower Temperate life zone.

257. *Astragalus militaris* n. sp. Pods about 2 mm. wide and high, and 1 cm. long, shining, with triquetrous-cordate cross section, deeply sulcate dorsally, not at all ventrally. Flowers pink-purple, spreading. Banner oval, about 4 mm. long, with sides reflexed in the middle about 1 mm. wide, abruptly erect at calyx tips, deeply notched; white spot filling the unreflexed banner blade, and traversed by spreading rays of purple; the groove fills the whole banner. Wings very large, oblong-elliptical, 2 mm. wide, as long as banner, concave to keel and very obtuse and rounded, with tips nearly horizontal, about 1 mm. longer than keel. Keel arched from base into about a half circle, about 3 mm. long and 2 mm. high,

very obtuse. Bracts triangular, about equaling the calyx tube and much longer than the 1 mm.-long pedicels. Calyx Hedeoma-like, about 1.5 mm. long, laterally flattened, broadly campanulate, very oblique at both ends, inserted a little below the middle of the end, sparsely long-hairy with appressed hairs, teeth triangular-subulate, lax, about as long as tube. Peduncles filiform, 5-10 cm. long, lax, axillary. Spikes 2-5 cm. long, becoming a little loose in fruit, never very dense. Leaves 5-7 cm. long, mostly all petioled. Leaflets 6-8 pairs, narrowly elliptical, nearly 1 cm. long, long-petiolulate and cuneate at base, distant, obtuse. Stipules triangular to subulate, hyaline below, 3-5 mm. long, not connate. Stems very slender and flexuous, nearly erect from a woody base, about a foot high, internodes rarely 2 cm. long. Soldier Canon near Colonia Juarez Chihuahua Mexico, Sept. 16, 1903, Jones. Lower Temperate life zone. I also refer to this Pringle's No. 1586 from Carretas Chihuahua Mexico which was distributed as *A. Hartwegi* and was considered by Watson to be *A. parvus*. Palmer's No. 441 from Durango Mexico with white flowers is the same.

258. *Astragalus Saltonis* n. sp. Pods as in *A. Hartwegi* but barely sulcate dorsally and not at all ventrally, with deltoid cross section, about 1.5 cm. long, nigrescent, papery and a little inflated, nearly straight. Flowers white with purple tips, and like the pods closely reflexed and densely clustered. Banner oval, arched to nearly a half circle at calyx tips, with sides closely reflexed fully 1 mm. wide above, about 4 mm. long. Wings oblong, arched, white, fully as long as banner or longer. Keel arched from base to tip in about one-third circle, and upper side about straight from base to tip, obtuse, about 3 mm. long and as long as or 1 mm. shorter than banner, conspicuous. Calyx tube narrowly campanulate, a little narrowed below and obtuse but about equally inserted, very oblique above, very nigrescent with fine soft rather spreading short hairs, teeth subulate nearly as long as tube and lax. Pedicels 1 mm. long. Bracts lanceolate, the lower 5-7 mm. long, lax and hyaline, hairy as in all the allied species. Peduncles stout, about 1 dm. long, subterminal. Leaves 5-10 cm. long, widely spreading and lax, the upper about sessile. Leaflets nearly linear to narrowly oblong, cuneate and long-petiolulate below, obtuse, 1 cm. long, nearly 15 pairs, softly silky-pubescent below with very fine and spreading hairs and rough surface, the upper side smooth. Stipules connate and large, often 1 cm. long. Stems decumbent, flexuous, not slender, about a foot long. Internodes 2-5 cm. long. Salto de Aqua Mexico, state of Mexico, No. 1751 Purpus. A plant from near Cima state of Mexico by J. N. Rose, Sept. 19, 1903, is a less developed form with smaller and shorter leaves.

259. *Astragalus vaccarum* Gray Pl. Wr. 2 43 (1853). *A. Daleæ* Greene. Pods softly pubescent, broadly sulcate to the middle, with reniform cross section. Flowers greenish-white (sometimes purple), very short and stubby. Banner about round, 2 mm. long, abruptly arched to more than erect, about as long as the obovate and rounded wings which a little surpass the keel. Keel with whole blade erect, half-oval-ovate, about 2 mm. high, obtusish. Calyx tube rather narrowly campanulate, hardly 1 mm. long, oblique at tip, teeth triangular, nearly as long as tube which is appressed and scantily hairy with long hairs. Bracts fully as long as calyx, lanceolate. Pedicels almost none. Peduncles filiform 5-15 cm. long, axillary. Leaves 3-8 cm. long, lax, the upper sessile. Leaflets 6-10 pairs, narrowly elliptical, cuneate and long-petiolulate below, obtuse, 5-15 mm. long, distant. Stipules triangular to subulate, not connate, often 5-8 mm. long. Stems rather slender, nearly erect, a foot or two high, branched below. Central New Mexico to the Huachuca Mts. Arizona and southward to Sinaloa, Durango, and Hidalgo Mexico. Blooming in July. Forms that are similar but with broader pods more like *A. Hartwegi* from the state of Mexico form

Pringle's No. 6445, distributed as *A. Seatonii*. Lower Temperate life zone. This is hardly more than a good variety of *A. Hartwegii*.

260. *Astragalus hypoleucus* Schauer Linnæa 20 747 (1847). Pods linear-oblong, 1-1.6 cm. long, 2-3 mm. wide, 1.5-2 mm. high, obcompressed, closely reflexed, a little arcuate, sulcate dorsally with V-shaped sulcus, apiculate, with cross section obcordate, with ventral suture a little raised externally, arranged in dense spikes. Flowers spicate to racemose-spicate, white, spreading, or slightly reflexed, 4-5 mm. long. Banner arched to 90° at tip of calyx tube; sides reflexed at base to 90° ; tip notched 1.5 mm. deep; groove barely evident; blade 4 mm. long, 2 mm. wide, oblong. Wings oblong-ovate, hooded, distant from keel and arched over it so that the keel and wings form the figure 3 laid on its side, about 1 mm. wide, 1 mm. high, ascending 10° . Keel very short and blunt, tip incurved at least 100° . Calyx tube villous-woolly, 2 mm. long, campanulate, not oblique at base; teeth triangular, the lower much the longer but not longer than tube. Bracts white-pubescent, 2 mm. long in fruit and closely recurved. Flowering pedicels barely evident. Peduncles persistent, with rachis 1-1.5 dm. long, floriferous on the upper one-half to one-third, shallow-sulcate. Leaves all but the lowest sessile, about 5-7 cm. long, often fascicled when they arise from the woody tips of the stems. Leaflets about 10 pairs, broadly to narrowly elliptical, not over 1.2 cm. long, thickish, rounded above, abruptly narrowed at base, rather long-petiolulate, not contiguous, rarely truncate, rather less pubescent above than below. Stipules connate almost to tip, scarious, barely adnate. Stems simple, floriferous above, lower parts often woody, decumbent, flexuous, 1-3 ft. long, internodes 3-7 cm. long, shallow-sulcate. Root woody; pubescence of whole plant silvery-white. Zacatecas, Puebla, Nuevo Leon, Hidalgo, and central Mexico. Lower Temperate life zone. This has the habit of *A. humistratus*.

261. *Astragalus oxyrhynchus* Hemsley Bot. Cent. Am. 1 265 (1880). Pods about 7 mm. long, oblong-ovate, with falcate and very acutely triangular tip, smooth, sulcate dorsally, with reniform cross section, somewhat obcompressed. Flowers 5-7 mm. long, broad, nearly sessile, purple. Banner round, purple-striped, abruptly arched at calyx tips to erect, about 3 mm. long, a trifle longer than wings. Wings oblong, arched, barely longer than the large keel. Keel nearly a half circle, obtuse. Calyx nigrescent, about 2 mm. long, teeth subulate and as long as tube. Bracts small, subulate-triangular. Peduncles 2-6 cm. long. Leaves 3-5 cm. long, nearly sessile. Leaflets 6-9 pairs, oblong-linear, 7-10 mm. long, obtuse, ashy with minute short and closely appressed hairs. Stems slender, flexuous, widely spreading to prostrate, with slender internodes. Valley of Mexico, San Luis Potosi, and state of Hidalgo. Tropical.

262. *Astragalus Seatonii* Jones Cont. 7 676 (1895). Pods half-oblong-oval, apiculate, not acuminate nor long-pointed, about 4 mm. long and 2 mm. wide, minutely stipitate, with nearly round cross section, a little sulcate dorsally and the suture a trifle intruded but not completely 2-celled, nigrescent. Flowers white or whitish, sessile, 3-4 mm. long, broad. Banner round, abruptly arched to erect at end of tube, about 2 mm. long. Wings narrow and about as long. Keel very arcuate, oblong and rounded, about as long as banner. Calyx almost hemispherical, about 1.5 mm. long, nigrescent, the triangular teeth a little shorter. Bracts and pedicels almost none. Peduncles about as long as leaves, 3-4 cm. long, axillary, spreading. Leaves wide, 3-4 cm. long, widely spreading, the upper sessile. Leaflets 10-12 pairs, 8-15 mm. long, linear, nearly smooth. Stipules small. Stems very slender and branched throughout, the branches widely spreading, decumbent from slender root branches, a foot or two long. Internodes about as long as the leaves, slender and with sparse leaves. Mt. Orizaba Mexico at 10,000 ft. alt. Middle Temperate life zone. Seaton. Blooming in July. Bourgeau's specimen belongs to *A. oxyrhynchus*.

Astragalus Seatonii var. **Crucis** n. var. Pods narrowly oblong, and shortly acuminate, 8-12 mm. long. Flowers about 4-5 mm. long. Upper stipules large, ovate and green. Leaflets narrowly oblong, 1 cm. long and 3 mm. wide. Pringle's No. 6445 Sierra de Las Cruces at 10,000 ft. alt., state of Mexico, August 13, 1896.

263. Astragalus Goldmani n. sp. Pods half-oval, about 5 mm. long, 3-4 mm. wide and 2 mm. high, ashy, cordate at base and about sessile, truncate and minutely deflexed-apiculate at tip, narrowly sulcate to the middle dorsally and wholly 2-celled to tip, rather flat or rounded ventrally and the suture thickened but not raised and straight to a little concave, cross section reniform to triquetrous-reniform, not cross-ribbed, closely reflexed in linear spikes 1-2 dm. long. Flowers white or ochroleucous, soon reflexed, 5-7 mm. long, stubby and wide. Banner nearly round, about 3 mm. long, abruptly arched to erect at end of calyx tube and with sides reflexed 1 mm. wide. Wings broadly oblong and blunt, arched 30°, as long as banner and 2 mm. longer than the half-circular keel which is fully as high as long and rounded and purple-tipped. Calyx hemispherical, cleft deeper above, equally inserted, nigrescent or silvery hairy on a minute and reflexed stout pedicel, teeth triangular, rather shorter than the tube. Bracts filiform, white, about 3 mm. long. Peduncles 1-2 dm. long, strict, in the upper axils, fruiting rachis often 3 dm. long, rather loosely fruited. Leaves about sessile above, rarely 1 dm. long, with elliptical-oblong leaflets 1-2 cm. long, which are long-petiolulate, rather distant, thin, sparsely to densely white-hairy with rather tangled hairs fixed by the base and sometimes rather woolly, leaflets on the lower leaves small and obovate, mostly rounded and obtuse but sometimes shortly acute. Stipules triangular-subulate, 4-6 mm. long, green. Stems slender, erect or decumbent only at base, 2-3 ft. high, simple, tufted from a slender and rather woody root. Probably Lower Temperate life zone. The type is No. 335619 National Herbarium, Goldman's No. 119 from Parral Chihuahua Mexico, Sept. 19, 1898. Lower Temperate life zone. E. A. Goldman. Other specimens which I refer here are Palmer's No. 440 (Nat. Heb. 304738) from Pasquiario Durango, 1896. Near Santa Gertrudis Tepic, Aug. 8, 1897, J. N. Rose, No. 302355, a woolly form with nigrescent calyx as in the type. E. Palmer No. 278 (Nat. Herb. 571298) from Tepehuanes Durango, June, 1906. This is a very robust form with stout stem and densely white-villose and white calyx.

264. Astragalus Clevelandi Greene Torr. Bull. 9 121 (1882). Pods about half-oval-ovate, with ventral suture inclined to be a little concave and with declined, pungent and minute triangular tip, broadly sulcate dorsally, smooth, very rigid, 5-6 mm. long, 2 mm. wide, 1-2 mm. high, with cross section deltoid-cordate. Flowers about 5 mm. long, in spikes which in fruit are often a foot long. Banner round, about 2 mm. long, with sides reflexed ½ mm. wide, arched abruptly at end of tube to 45°, a little shorter than wings. Wings oblong and with a lanceolate tip, arched to 45°, fully 1 mm. wide, fully twice as long as keel. Keel arched to a half circle from base, obtuse, about 2 mm. high and long. Calyx broadly campanulate, equally inserted below, rather oblique at tip and with very broad upper sinus, with teeth unequal, subulate and as long as tube or more, ashy. Pedicels and bracts minute, about equal, the latter triangular, 2 mm. long. Peduncles filiform, 5-10 cm. long, strict, many. Upper leaves sessile, the lower smaller and short-petioled, 5-7 cm. long. Leaflets 5-12 mm. long, narrowly elliptical, obtuse, green, but minutely pubescent, long-petiolulate. Stipules subulate, about 4 mm. long. Stems a foot or two high, very slender, ascending to erect, with peduncles in all the upper axils. Internodes slender but shorter than the leaves. Lake County, California. Tropical.

265. Astragalus Purpusi Jones Cont. 14 34 (1912). Pods re-

flexed, obliquely ovate to half-oval, thin, shortly acute at both ends, conspicuously flattened laterally, with triquetrous-cordate cross section, 4-5 mm. long, 2 mm. high, minutely appressed-pubescent, rather strongly nerved, triangular-apiculate, ventral suture slightly arched and raised, dorsal suture sulcate to the middle, then produced to the ventral as a partition below. Flowers purple, about 4 mm. long, in dense heads which become short spikes in fruit, many (10-15), spreading and soon reflexed. Banner obovate, about 2 mm. long, abruptly arched at calyx tips to erect, purple and dark-striped, slightly longer than the wings. Wings broadly linear, nearly straight, blunt, white or purple, about $\frac{1}{2}$ mm. longer than keel. Keel very broad, straight, about 2 mm. long and high, rounded to about a half circle, the tip erect. Calyx obconic, equally inserted, about 1 mm. long, appressed-black-hairy, teeth triangular, nearly equal, half as long as tube. Bracts ovate, hyaline, 1 mm. long, about as long as the fruiting pedicels. Peduncles filiform, in the upper axils, 2-3 cm. long. Leaves 2-3 cm. long, spreading, all nearly sessile, a little longer than the internodes, with filiform rachis. Leaflets about 10 pairs, notched, oval-obovate to oblanceolate, thickish, mostly folded, nearly contiguous, smooth above, sparsely and minutely pubescent below, the broader ones 2 mm. long, the others 4 mm. long and 1.5-2 mm. wide. Stipules conspicuous, hyaline below, connate, the lower ones quadrangular and truncate, the upper deltoid, about 3-5 mm. long. Stems very many and woody below, prostrate and caespitose, branched, flexuous, rather stout for the plant, hardly a foot long. Plants with the habit of *A. tegetarioides*, and *montanus*. Sierra de Parras, Coahuila, Mexico, at 9,000 ft. alt. Middle Temperate life zone. No. 4582
Purpus.

DIDYMOCARPI. 30.

Pods didymous, or with sides distorted or corrugated, or in *A. Breweri* oblong-ovate and long-beaked and sulcate only below, 3-5 mm. long (about 7 mm. long in *A. Breweri*), from ovate to broader than long, mostly corrugated transversely, rather coriaceous, not or but little inflated, evidently stipitate only in *A. Brazoensis*, cordate at base, 2-celled. Flowers about sessile in dense (loose in *A. reflexus*) heads, sometimes elongating to spikes in fruit, minute or small, rarely 8 mm. long. Calyx long-villous. Leaflets never acute, small, mostly notched, not over 8 pairs. Stipules not connate. Weak, low and slender annuals (possibly perennials in *A. diphacus* and *Angelinus*). Tropical plants growing on prairies and plains.

KEY.

- A.** Pods straight, evidently longer than calyx, sharp, or triangular at tip, much obcompressed, broadly bisulcate ventrally, at least as long as wide or longer, closely reflexed in short and narrow spikes, with the lower edges incurved on the sides and with ventral suture sharp and raised, with the tip rather arcuate, strongly cross-ribbed around the margins, deeply sulcate dorsally, much distorted and with cross-section nearly that of the letter A without the bar, appearing as if minutely stipitate. Peduncles filiform, axillary. Leaflets notched, not over 5 pairs. Stems filiform, widely spreading and much branched.
- Pods 7 mm. long, oblong-ovate. 266 *reflexus*.
 Pods 3-4 mm. long and wide, not oblong-ovate. 267 *nigrescens*.
- 2A.** Pods 7 mm. long and with conical beak nearly as much more, erect in heads, round to reniform in cross section, not corrugated. Flowers about 7-8 mm. long. Low annuals.
- Pods long-beaked. 268 *Breweri*
- 3A.** Pods about as broad as long or broader, very obtuse and rounded at both ends, apiculate, didymous, or half-oblate-oval.
- 3AB.** Pods scarcely longer than the calyx, about 3 mm. long, coarsely and strongly cross-corrugated, sessile, erect in dense heads, about oval, not obcompressed, not inflated. Flowers 3-8 mm. long, many, white or purple, with the same tendency to become rudimentary as in *A. nigrescens*. Weak annuals.
- Pods 3 mm. long, with cross-section a crescent. 269 *didymocarpus*.
 Pods 3-3 mm long, with cross-section flatly tripetrous-cordate. 270 *dispermus*.

3A2B. Pods conspicuously longer than calyx, smooth, ribbed, appearing a little inflated, inclined to be notched at both ends, sessile, rather wider than long. Mexican perennials or winter annuals with rather woody stems late in the season.

Pods about round.

271 *diphacus*

Pods oblatelately oval-ovate.

272 *Angelinus*.

3A3B. Pods smooth, stipitate, reflexed. Texan.

Pods about reniform.

273 *Brazoensis*.

266. *Astragalus reflexus* T. & G. Fl. 1 334 (1838). Pods about 7 mm. long, oblong-ovate, sharply acute, about twice as long as wide, widely sulcate dorsally, flat ventrally and with suture raised, with rounded sides, smooth, 4 mm. wide and 2 mm. high. Flowers reflexed, purple, nearly sessile, several in a loose head, about 7 mm. long. Banner narrow, arched abruptly at calyx tips to erect, 2-3 mm. longer than keel. Wings much shorter than keel, broad. Keel with straight base and then produced into a narrowly triangular, ascending and very acute beak. Calyx tube about 1 mm. long, campanulate, acute at base, with broad sinuses and teeth subulate and about as long as tube. Bracts subulate, about 2 mm. long. Pedicels evident but very short. Peduncles longer than the leaves 3-6 cm. long. Leaves 3-6 cm. long, the uppermost nearly sessile, the lowest half petiole. Leaflets about 6 pairs, 4-8 mm. long, about obovate, not contiguous, strongly petiolulate, truncate to a little notched. Stems straggling, about a foot long or less. Stipules rather large, 3-5 mm. long, ovate or broader. Whole plant nearly smooth except the calyx. Central Texas.

267. *Astragalus nigrescens* Nutt. Pl. Gambel 152 (1848). *A. Gambellianus* Sheldon. *Hesperastragalus* Heller. Pods 3-4 mm. wide and long, deltoid-ovate to nearly round, pubescent, either deltoid at tip or with a mere upturned apiculation, sharply sulcate dorsally, the ventral suture mostly elevated and the space between it and the thickened sides forming deep grooves. Flowers normally 2-4 mm. long, very variable, white or purple, mostly scarcely opening and rather cleistogamous as in *Wrightii* and *lotiflorus*, many in heads but becoming spikes in fruit. Banner round to ovate, the sides little or much reflexed, normally 1-3 mm. long, arched 45° or less, as long as or 2 mm. longer than wings. Wings lanceolate-oblong and narrowed above, rounded, white, somewhat arched, a little longer than keel. Keel about 2 mm. long, with straight or arched base, abruptly bent and tip erect and acutish, about 1 mm. high, purple. Under specially favorable circumstances the flowers are 7 mm. long and then the species is *A. Elmeri* Greene. Calyx tube black-hairy, turbinate to narrowly campanulate, acute at base, hardly 1 mm. long, the teeth about half as long and rather deltoid. Bracts hyaline, lanceolate, about 1 mm. long, pedicels mere rudiments. Peduncles 3-5 cm. long, somewhat spreading. Fruiting spikes 1-5 cm. long, narrow. Leaves 2-4 cm. long, thin, mostly nearly sessile, ascending. Leaflets 4-6 pairs, cuneate-oblong, deeply notched, long-petiolulate, 3-8 mm. long, distant. Stipules triangular, hyaline, 3-5 mm. long. Whole plant pubescent with spreading and long hairs. Stems seldom a foot long, much branched. Common from the Sacramento valley to the coast and south to Mexico, also on the southern islands of California.

268. *Astragalus Breweri* Gray Proc. Am. Acad. 6 207 (1864). Pods few, oblong-ovate, ashy or silvery, 3-4 mm. wide, with ventral suture not raised nor evident, sharply sulcate to the middle dorsally, abruptly contracted at tip into a straight and subulate beak nearly as long as body, few. Flowers purple, spreading. Banner very thin, often 8 mm. long, oblong, arched abruptly at calyx tips to 45°, with sides reflexed somewhat, about 2 mm. longer than wings. Wings oblong-ob lanceolate to half-rhomboidal, 2-3 mm. longer than

keel, white. Keel about 3 mm. long, 2 mm. high, the very broadly deltoid and obtuse tip only a little higher than the rest, very dark-purple, shining through the banner and wings, abruptly rounded. Calyx tube black-hairy, about 2 mm. long, narrowly campanulate, acute at base, with teeth from half to as long as tube. Pedicels and bracts minute. Peduncles rather stout for the plant, 3-5 cm. long. Leaves 3-5 cm. long, rather few, with short but evident petiole, delicate, spreading. Leaflets 4-5 pairs, cuneate-oblong-obovate, not contiguous, sparsely pubescent below, 5-7 mm. long. Stipules deltoid, green, about 2-3 mm. long. Stems short, flexuous, much branched. Pubescence sparse, short, the upper sides of leaflets smooth. In fields from Mendocino Co. to San Francisco.

269. *Astragalus didymocarpus* H. & A. Bot. Beech. 334 t 81 (1841). *A. Catalinensis* Nutt., *Hesperastragalus* Heller. Pods about 3 mm. long and 2 mm. high and wide, half-oblate-oval, or obliquely ovate, deeply sulcate dorsally to beyond the middle and with cross section a crescent with rounded ends, smooth, ventral suture raised and very thick and with strong ribs running out from it and meshing on the angles much as in *Euphorbia* seeds. Flowers purple or white, 4-8 mm. long in ovate to oblong heads. Banner oval-ovate to oblong, 3-7 mm. long, arched at calyx tips to 45°, when colored with large, veined white spot low down, 1-2 mm. longer than wings. Wings oblanceolate to obovate, 1 mm. wide, white at tip and purple below, about 1 mm. longer than keel. Keel straight, 3-4 mm. long, 2 mm. high, with triangular ascending tip rounded and about 2.5 mm. high. Calyx tube campanulate, acute at base, about 2 mm. long, with sharp sinuses. Bracts ovate, hyaline, about 1 mm. long. Pedicels none. Peduncles 3-5 cm. long, longer than leaves. Leaves 3-4 cm. long, lax. Leaflets 3-5 pairs, narrowly cuneate-oblong and with contracted tip deeply notched, about 1 cm. long, distant. Stipules triangular, reflexed, 2-3 mm. long. Stems flexuous, erect or spreading, branched below, very slender, with internodes few and 1-7 cm. long. Common in all the valleys from central California to San Quentin Lower California, running a little over into the Great Basin at Mojave.

270. *Astragalus dispermus* Gray Proc. Am. Acad. 13 365 (1878). Pods oblately oval to deltoid-ovate, 3-4 mm. long, 2-2.5 mm. wide and 1.5-2 mm. high, with cross section flatly triquetrous-cordate with sharp angles (or rounded), pubescent, slightly to deeply corrugated, sulcate as in *didymocarpus* and with ventral suture convex as in that species but a mere line. Flowers in a dense ovate head, purple, 3-5 mm. long. Banner oval, 2-3 mm. long, arched to 45°, often not exceeding the calyx tips, rarely 1 mm. longer than wings. Wings white, obliquely oblong-lanceolate, 1/2-1 mm. longer than keel. Keel straight, about 3 mm. long, abruptly erect at tip and 2 mm. high, base 1.5 mm. high. Bracts green, subulate, about 1 mm. long, scarcely visible. Calyx conspicuously white-shaggy, the hairs concealing the shape, the teeth setaceous subulate, green, longer than the tube. Peduncles 1-5 cm. long, axillary. Leaves 2-4 cm. long, all petioled, but upper short, spreading. Leaflets thick, 3-5 pairs, distant, oblong with cuneate base to cuneate-notched, long-petiolate, 3-7 mm. long. Stipules deltoid with subulate tips, green, 3 mm. long. Whole plant white-pubescent with spreading hairs. Stems prostrate, at least the outer ones, often 2 ft. long, with long internodes, branching below. From Rhyolite, Nevada, to Wickenburg and Hillside, Arizona, through the Charleston Mts. and throughout the deserts to both sides of the San Bernardino Mts. and southward into Mexico, San Diego, California, etc. This hybridizes with *A. didymocarpus* forming ***A. dispermus* x *didymocarpus***, having the pods of *didymocarpus* and the pubescence and leaves of *dispermus*. The hybrid grows at Banning, California.

271. *Astragalus diphacus* Watson Proc. Am. Acad. 17 342 (1882). Pods 4-8 mm. long, about round, a little notched at both

ends, about 2 mm. high, obcompressed somewhat or not at all, didymous, sessile, few in loose and oblong heads, not reflexed, apparently smooth, about 6 mm. wide, apiculate with a declined tip, finely and closely cross-ribbed, sulcate ventrally, both sutures raised as narrow ribs, the dorsal convex and little if at all sulcate. Flowers about 8 mm. long, purple, few in loose heads, narrow. Banner ovate, arched a little at calyx tips, with sides reflexed $\frac{1}{2}$ mm. wide, about 5 mm. long, 1 mm. longer than wings. Wings obliquely oblong-lanceolate, 2 mm. longer than keel, arched a little, purple-tipped. Keel about 3 mm. long and high, arched from base to a half circle, very obtuse, about 2 mm. wide in the middle. Calyx narrowly campanulate, 3 mm. long, acute at base, nigrescent, with straight lower side and arched upper side, with subulate teeth lax and nearly as long as tube. Bracts subulate, 2-3 mm. long, pedicels 1-2 mm. long. Peduncles 5-15 cm. long, longer than the leaves. Leaves 5-10 cm. long, short-petioled. Leaflets nearly linear, rather obtuse, apiculate, 7-15 mm. long, 6-12 pairs, rather long-petiolulate, minutely pubescent with short and appressed white hairs, smooth above, distant. Stipules lanceolate. Stems from perennial roots and in the type erect, about a foot high and freely branched with short internodes and many leaves. On hillsides at Zacatecas Mexico. Tropical.

Astragalus diphacus var. peonis Jones Cont. 10 65 (1902). Stems prostrate with ascending tips, silvery hoary throughout. Flowers white, sides of banner folded back to the midrib nearly all the length except at the very apex where with the notch is formed a heart-shaped enlargement, tip of banner is at nearly 30° to the claw, it begins to curve at a point about 2 mm. beyond the calyx teeth, the outline of the banner as folded is oblong with a triangular base, no white spot but banner waterlined. Wings ascending 30° , obliquely-oblong-oblong-lanceolate, rounded, 1 mm. wide, 1 mm. longer than keel and exposing the base of keel. Tip of keel blunt and incurved 90° , rounded at apex. The wings are incurved at tip and flat. Flowers declined generally. Pod didymous, chartaceous, cross section is that of the figure 8 laid on its side. Leaflets about 8 pairs, folded, 5-10 mm. long, elliptical. Calyx teeth triangular and about half the tube which is rather hoary with white and black hairs intermixed. Stipules deltoid, erect, green, 3 mm. long. Leaves 2-3 cm. long. Zacatecas Mexico, Jones. May 16, 1892.

272. Astragalus Angelinus n. sp. Pods very obliquely oval-ovate, 5-7 mm. long, 3-4 mm. wide, 3 mm. high, truncate to slightly cordate at the sessile base, reflexed in dense and short spikes, opening first at base, faintly cross-ribbed, inclined to be flattened along both sutures or very slightly shallow-sulcate, the ventral suture straight above and ending in a minute mucro which is a little declined, below it is much arched, the suture is very thick but little raised, dorsal suture scarcely evident, very convex throughout, tip of pod obtuse to a little retuse, but pod never didymous, cross section oblately oval and with the ventral side rather flattened, completely 2-celled to tip, coriaceous and very rigid, a little inflated, minutely pubescent. Flowers gone. Calyx campanulate to subglobose, about 2 mm. long, with subulate teeth about as long. Pedicels stout, reflexed, about 2 mm. long, nearly equaled by the triangular bracts. Peduncles rather slender, about 1 dm. long, axillary throughout, arched, fruiting spikes 3-5 cm. long, oblong. Leaves nearly 1 dm. long, about sessile, of 10-12 linear and retuse leaflets narrowed and long-petiolulate below, distant, 1-1.5 cm. long, many, with short internodes, spreading. Stipules triangular-subulate, 3-4 mm. long, not connate. Stems slender, weak, and depressed or decumbent from a rather woody but slender base, tufted and branching at base, rarely a foot long. From near San Angel valley of Mexico, J. N. Rose, Aug. 21, 1903. Nat. Herb. No. 450040. Probably Lower Temperate life zone. Also near El Salto Hidalgo,

Mexico, Sept. 16, 1903, by J. N. Rose, Nat. Herb. No. 450662.

273. *Astragalus Brazoensis* Buckley Proc. Phil. Acad. 452 (1861). Pods about reniform, 4 mm. long, 5 mm. wide and 2 mm. high, cuspidate with upturned sharp prickle, much obcompressed, reflexed on a stipe as long as calyx, finely cross-nerved, smooth and shining. Flowers purple, about 5 mm. long, in a loose head. Banner 4 mm. long, oblong, arched to erect and abruptly at end of calyx tube, with sides reflexed about 1 mm. wide below. Wings oblong, a little arched, with the upper side white and the lower side purple from base to tip, a little longer than keel and 2 mm. shorter than banner. Keel 4 mm. long, with straight base and front of tip straight and erect, triangular, acute, purple, 3 mm. high. Calyx tube campanulate, about 1 mm. long, acute at base, with rounded sinuses, the subulate teeth about as long and straight. Pedicels about 1 mm. long and equaling the ovate bracts. Peduncles about 3-5 cm. long. Leaves 3-5 cm. long, short-petioled. Leaflets 6-7 pairs, oblong-obovate, about 5 mm. long, notched, short-petiolulate, pubescent only on the margins and midrib with slender hairs. Internodes shorter than the leaves. Outer stems decumbent below, flexuous, sulcate. Stipules triangular, green, 3 mm. long. Common on Texan prairies from the center of the state to the sea.

CORRECTIONS.

Page 16, line 20, read calycosus.

Transpose lines 3 and 4 on page 14.

Page 55, 7th line from bottom, read argillosus.

Page 56, last line read coccineus.

Page 57, omit last line.

Page 60, line 5, read correlative.

Page 89, under A. Bourgovii, line 2, read 1.5 cm. long instead of 15.

On page 14, lines 11 and 12, from the bottom, read: "He again makes a new name for an old section, the Sarcocarpi, by calling it Carnosocarpi."

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ASTRAGALUS

- a. aboriginum* Rich. Frankl. Jour. App. 18 1823 No. 87
Atelophragma aboriginum (Rich.) Rydberg. Torr. Bull. 32 660 19
lineare Rydberg Torr. Bull. 40 51 1913.
Homalobus aboriginum (Rich.) Rydberg Fl. Mont. 246 1900.
Phaca aboriginum (Rich.) Hooker Fl. Bor. Am. 1 143 t. 56 1830.
 Var. *glabriusculus* (Hook.) Rydberg Cont. Nat. Herb. 3 492 1896.
Phaca glabriusculus Hooker Fl. Bor. Am. 1 144 1830.
Astragalus glabriusculus (Hook.) Gray Proc. Acad. Am. 6 204 1864
 Var. *major* Gray Proc. Phil. Acad. of 1863 p. 60
 Gray Proc. Am. Acad. 6 204 1864.
 Var. *spatiosus* Sheldon Minn. Bot. Stud. 9 156 1894.
 Forwoodii Watson Proc. Am. Acad. 25 129 1890.
Homalobus glabriusculus (Hook.) Rydberg Fl. Mont. 246 1900
Atelophragma Forwoodii (Watson) Rydberg Torr. Bull. 40 51 1 13.
 Var. *fastigiorum* Jones.
accidens Watson Proc. Am. Acad. 22 471 1887. No. 125
 Var. *Pacificus* (Sheldon) Jones.
 A. Hendersoni Watson Proc. Am. Acad. 22 471 1887
 Watsoni Sheldon Minn. Bot. Stud. 9 23 1894.
 Pacificus " " " " " 174 "
 pruniformis Jones Cont. 8 12 1898.
 cymatodes Greene Pitt. 3 196 1897.
accumbens Sheldon Minn. Bot. Stud. 9 20 1894. No. 94
 procumbens Watson Proc. Am. Acad. 20 361 1885; Not of H. & A.
acerbus Sheldon Minn. Bot. Stud. 9 123 1894 is *A. Wingatensis* Var.
aculeatus Nelson Torr. Bull. 26 10 1899 is *A. montanus* Var. *tegetarius*.
acutirostris Watson Proc. Am. Acad. 20 361 1885. No. 241
 Oxytropis acutirostris (Watson) Jones Cont. 7 677 1895.
 Aragallus acutirostris (Watson) Heller Cat. Ed. 2 4 1897.
adanus Nelson Bot. Gaz. 53 222 1912. No. 120
adsurgens Pall. Ast. 40, 44 t 31 1800.
 Phaca adsurgens (Pall.) Piper Fl. Wash. 372 1906.
 Var. *robustior* Hook. Fl. Bor. Am. 1 149 1834 is *A. nitidus* Var.
agrestis Douglas in Hook. Fl. Bor. Am. 1 148 1834. No. 131
 goniatus Nutt. in T. & G. Fl. 1 330 1838.
 Hypoglottis Var. *bracteatus* Osterhout Torr. Bull. 26 1899.
 Phaca agrestis (Dougl.) Piper Fl. Wash. 372 1906.
 Var. *polyspermus* (T & G.) Jones Cont. 10 65 1902
 A. Hypoglottis Var. *polyspermus* T & G. Fl. N. A 1 328 1838.
 virgultulus Sheldon Minn. Bot. Stud. 9 165 1894
albatus Sheldon " " " " " 128 " is *A. aridus*
albens Greene Bull. Cal. Acad. 3 156 1885. No. 227.
albulus Wooton & Standley Cont. Nat. Herb. 16 136 1913 is *humistratus*
allanaris Sheldon Minn. Bot. Stud. 9 141 1894 is *glareosus*
allochrous Gray Proc. Am. Acad. 13 366 1878. No. 63.
 Wootoni Sheldon Minn. Bot. Stud. 9 138 1894.

alpinus L. 760 is andinus.
 Phaca alpina Piper Fl. Wash. 371 1906, not Linnæus
 Phaca astragalina DC. Ast. 64 1802
 A. astragalinus (DC.) Sheldon Minn. Bot. Stud. 9 65 1894
 giganteus Sheldon Minn. Bot. Stud. 9 65 1894, not Pallas
 not alpinus Var. giganteus Pallas which is A. oroboides
 alpinus (L.) Sheldon Minn. Bot. Stud. 9 65 1894 No. 8
 Phaca alpina L. 755
 Tragacantha alpina (L.) Kuntze Rev. Gen. 2 943 1891
 Phaca frigida L. Fl. Suess, 2 657 1755
 A. frigidus (L.) Gray Proc. Phil. Acad. of 1863 p. 60 (Ser. 2 Vol 7)
 Var. Americanus (Hook.) Sheldon Minn. Bot. Stud. 9 133
 1894 is A. Americanus
 Var. littoralis (Hook.) Sheldon Minn. Bot. Stud. 9 133 1894
 Phaca frigida Var. littoralis Hooker Fl. Bor. Am. 1 140 1830
 A. frigidus Var. littoralis (Hook.) Watson Bib. Index 193 1878
 altus Wootton & Standley Cont. Nat. Herb. 16 136 1913 is A. strigosus
 Var. brevidentatus
 Alvordensis Jones Cont. 10 67 1903 No. 100
 Americanus (Hook.) Jones Cont. 8 8 1898 No. 90
 Phaca frigida Var. Americana Hooker Fl. Bor. Am. 1 140 1830
 A. alpinus Var. Americanus (Hook.) Sheldon Minn. Bot. Stud. 9 133
 1894
 frigidus Var. Americanus (Hook.) Watson Bib. Index 193 1878
 ammolutus Greene Erythea 3 76 1895 is lotiflorus Var. brachypus
 amphioxus Blankenship Stud. Mont. Pl. 1 72 1905 is miser
 amphioxys Gray Proc. Am. Acad. 13 366 1878 No. 174
 crescenticarpus Sheldon Minn. Bot. Stud. 9 148 1894
 selenius Greene Erythea 3 76 1895
 Xylophacos amphioxys (Gray) Rydberg Torr. Bull. 32 662 1905
 aragalloides Rydberg Torr. Bull. 34 48 1907
 Var. brachylobus Gray Proc. Am. Acad. 13 367 1878 is remulcus
 Var. vespertinus (Sheldon) Jones
 A. vespertinus Sheldon Minn. Bot. Stud. 9 150 1894
 Xylophacos vespertinus (Sheldon) Rydberg Torr. Bull. 32 662 1905
 amphioxys x Layneæ Jones
 amplexus Payson Bot. Gaz. 60 378 1915 is lentiginosus var. palans
 ampullarius Watson Am. Nat. 7 300 1873 No. 114
 Phaca ampullaria (Watson) Rydberg Torr. Bull. 40 47 1913
 Andersoni Gray Proc. Am. Acad. 6 524 1865 No. 225
 Tragacantha Andersoni (Gray) Kuntze Rev. Gen. 2 943 1891
 andinus (Nutt.) Jones No. 91
 Phaca andina Nutt. in T. & G. Fl. N. A. 1 345 1838
 A. alpinus L. 760
 astragalinus (DC.) Sheldon Minn. Bot. Stud. 9 65 1894
 Phaca astragalina DC. Ast. 64 1802
 Tium alpinum [L.] Rydberg Torr. Bull. 32 659 1905
 anemophilus Greene Bull. Cal. Acad. 4 186 1885 is A. vestitus
 Angelinus Jones No. 272
 angustus Jones Cont. 7 635 1895 and Zoe 4 37 1893 is A. pictus
 Var. pictus [Gray] Jones Cont. 7 635 1895 is pictus
 Var. ceramicus [Sheldon] Jones Cont. 10 62 1902 is pictus
 Var. longifolius [Pursh] " " 7 635 1895 is pictus var.
 Var. imperfectus [Sheldon] " " 10 62 1902 is pictus var. filifol.
 anisus Jones Cont. 4 34 1893 No. 194
 Antiselli Gray Bot. Cal. 1 152 1876 No. 5
 Hasseanus Sheldon Minn. Bot. Stud. 9 124 1894
 Var. phoxus Jones Cont. 10 65 1902
 A. gaviotus Elmer Bot. Gaz. 39 54 1905
 Antoninus Watson Proc. Am. Acad. 17 343 1882 No. 157
 apertus Sheldon Minn. Bot. Stud. 9 166 1894
 ervoides H. & A. Bot. Beech. 417 1841
 apilosus Sheldon Minn. Bot. Stud. 9 22 1894 is glaber
 araneosus Sheldon Minn. Bot. Stud. 9 170 1894 is lentiginosus
 var. palans
 argillosus Jones Cont. 2 241 1891 No. 202
 Cnemidophacos argillosus [Jones] Rydberg Torr. Bull. 40 50 1913

- argophyllus Nutt. in T. & G. Fl. N. A. 1 331 1838 No. 167
 A. Uintensis Jones Cont. 7 670 1895
 Xylophacos argophyllus (Nutt) Rydberg Torr. Bull. 40 49 1913
 Uintensis (Jones) Rydberg " " " 32 662 1905
 Var. castanæformis (Watson) Jones Cont. 10 62 1902
 A. castanæformis Watson Proc. Am. Acad. 20 361 1885
 Var. Martini Jones
 Var. Panguicensis Jones Cont. 7 671 1895 as Chamæleuce var., and
 Cont 8 5 1898
 A. Panguicensis Jones Cont. 10 62 1902
 Var. pephragmenus Jones Cont. 5 267 1893 as species
 aridus Gray Proc. Am. Acad. 6 223 1864. No. 37
 Tragacantha arida (Gray) Kuntze Rev. Gen. 2 943 1891
 A. albatuS Sheldon Minn. Bot. Stud. 9 128 1894
 arietinus Jones Cont. 7 653 1895 is cibarius
 Var. stipularis Jones Cont. 7 654 1895 is desperatus
 Arizonicus Gray Proc. Am. Acad. 7 398 1868 No. 218
 Tragacantha Arizonica (Gray) Kuntze Rev. Gen. 2 943 1891
 arrectus Gray Proc. Am. Acad. 8 289 1870 No. 121
 A. leucophyllus Hook. Lond. Jour. Bot. 6 211 1847
 Palousensis Piper Bot. Gaz. 22 489 1896
 atropubescens C. & F. Bot. Gaz. 18 300 1893
 Cusickii Rydberg Torr. Bull. 26 542 1899
 Malheurensis Heller Cat. Ed. 2 7 1900
 Phaca arrecta (Gray) Piper Fl. Wash. 371 1906
 Tium arrectum (Gray) Rydberg Torr. Bull. 40 49 1913
 atropubescens (C. & F.) Rydberg Torr. Bull. 40 49 1913
 Var. Leibergi Jones Cont. 10 68 1902
 A. " " " 7 663 1895
 Phaca arrecta var. Leibergi (Jones) Piper Fl. Wash. 371 1906
 Var. Kelseyi (Rydberg Fl. Mont. 241 1900 as species)
 A. eremiticus var. Spencianus Jones Cont. 10 60 1902
 Boiseanus Nelson Bot. Gaz. 53 223 1912
 Cystium Boiseanum (Nelson) Rydberg Torr. Bull. 40 50 1913
 Var. eremiticus (Sheldon) Jones Cont. 7 665 1895
 A. eremiticus Sheldon Minn. Bot. Stud. 9 161 1894
 Tium eremiticum (Sheldon) Rydberg Torr. Bull. 40 49 1913
 Var. Palousensis (Piper) Jones Cont. 10 68 1902 is arrectus
 Var. remotus Jones
 Var. scaphoides Jones Cont. 7 664 1895
 A. scaphoides Rydberg Fl. Mont. 241 1900, (a blunder of Rydberg)
 A. scaphoides Jones Cont. 10 69 1902
 Phacopsis scaphoides (Jones) Rydberg Torr. Bull. 40 52 1913
 Artemisiarum Jones Cont. 6 369 1894 is Beckwithii var. purpureus
 Arthuri Jones Cont. 8 20 1898 No. 233
 Atelophragma Arthuri (Jones) Rydberg Torr. Bull. 40 51 1913
 Arthu-Schottii Gray Proc. Am. Acad. 6 209 1864 is lentiginosus var.
 artipes Gray Proc. Am. Acad. 13 370 1878 is oophorus
 asclepiadoides Jones Cont. 2 239 1891 No. 116
 Jonesiella asclepiadoides (Jones) Torr. Bull. Rydberg 33 661 1905
 astragalinus [DC.] Sheldon Minn. Bot. Stud. 9 65 1894 is andinus
 Phaca astragalina DC. Astragalus 64 1802
 asymmetricus Sheldon Minn. Bot. Stud. 9 23 1894 is leucophyllus
 atratus Watson Bot. King 69 437 t. 11 1871 No. 138
 atratus var. stenophyllus Jones Cont. 3 297 1893
 var. arctus Sheldon Minn. Bot. Stud. 9 160 1894
 Trigacantha atrata [Watson] Kuntze Rev. Gen. 2 943 1891
 Hamosa atrata [Watson] Rydberg Torr. Bull. 34 48 1907
 Var. mensanus Jones Cont. 7 665 1895
 Var. phyllophorus Jones Cont. 10 62 1902
 Var. Owyheensis [Nelson Bot. Gaz. 55 375 1913 as species]
 atropubescens C. & F. Bot. Gaz. 18 300 1893 is arrectus
 Austinæ Bot. Cal. 1 156 1876 No. 132
 Tragacantha Austinæ [Gray] Kuntze Rev. Gen. 2 943 1891
 Bahaensis Sheldon Minn. Bot. Stud. 9 169 1894 is Hornii var.
 Batesii Nelson 54 150 1912 is lotiflorus var. Reverchoni

- Beckwithii* T. & G. Pac. R. R. Rep. 2 pt. 2 120 1855 No. 77
Tragacantha Beckwithii (T. & G.) Kuntze Rev. Gen. 2 943 1891
Phaca Beckwithii (T. & G.) Piper Fl. Wash. 371 1906
 Var. *purpureus* Jones Cont 3 288 1893
 A. Artemisiarum Jones Cont 9 46 1900
 Phaca Artemisiarum (Jones) Rydberg Torr. Bull. 40 48 1913
 Var. *Weiserensis* Jones Cont. 9 47 1900
Bernardinus Jones Cont. 7 661 1895 No. 220
bicristatus Gray Proc. Am. Acad. 19 75 1883 No. 109
 Var. *tetrapteroides* Jones Cont. 10 58 1902
bidentatus H.B.K. Nov. Gen. & Sp. 6 493 1824. See *Guatamalensis*
Bigelovii Gray Pl. Wr. 2 42 1853 No. 188
 A. Mogollonicus Greene Torr. Bull. 8 97 1881
 Tragacantha Bigelovii (Gray) Kuntze Rev. Gen. 2 943 1891
 Var. *Thompsonæ* (Watson) Jones Cont 8 23 1898
 A. Thompsonæ Watson Proc. Am. Acad. 10 345 1875
 syrticolus Sheldon Minn. Bot. Stud. 9 22 1894
 Var. *Matthewsii* (Watson) Jones
 A. Matthewsii Watson Proc. Am. Acad. 10 345 1875
bisulcatus (Hook.) Gray Pac. R. R. Rep. 12 42 t. 1 B 1860 No. 206
Phaca bisulcata Hooker Fl. Bor. Am. 1 145 1834
Tragacantha bisulcata (Hook.) Kuntze Rev. Gen. 2 943 1891
 Var. *decalvans* Gandoger Bull. Soc. France 48 15 1902
 Diholcos decalvans (Gandoger) Rydberg Torr. Bull. 32 664 1905
 scobinatulus (Sheldon) Rydberg Torr. Bull. 40 51 1913
Blakei Eggleston Bot. Gaz. 20 271 1895 is *Labradoricus*
Bodini Sheldon Minn. Bot. Stud. 9 122 1894 is *debilis*
Boiseanus Nelson Bot. Gaz. 53 223 1912 is *arrectus* var. *Kelseyi*
Bolanderi Gray Proc. Am. Acad. 7 337 1868 No. 124
 Tragacantha Bolanderi (Gray) Kuntze Rev. Gen. 2 943 1891
 A. supervacaneus Greene Erythea 1 221 1893
Booneanus Nelson Bot. Gaz. 53 223 1912 is *glareosus*
Bourgovii Gray Proc. Am. Acad. 6 227 1864 No. 29
 Tragacantha Bourgovii (Gray) Kuntze Rev. Gen. 2 943 1891
 Homalobus Bourgovii (Gray) Rydberg Fl. Mont. 247 1900
Brandegei Porter Fl. Col. 24 187 No. 144
 Tragacantha Brandegei (Porter) Kuntze Rev. Gen. 2 943 1891
 Atelophragma Brandegei (Porter) Rydberg Torr. Bull. 32 660 1905
Brauntoni Parish Bull. S. Cal. Acad. Sci. 2 26 1902 No. 134
Brazoensis Buckley Proc. Phil. Acad. (of 1861) 452 1862 No. 273
 Tragacantha Brazoensis (Buckley) Kuntze Rev. Gen. 2 943 1891
brevicaulis Nelson Torr. Bull. 26 9 1899 is *calycosus*
Breweri Gray Proc. Am. Acad. 6 207 1864 No. 268
 Tragacantha Breweri (Gray) Kuntze Rev. Gen. 2 943 1891
cæspitosus [Nutt.] Gray Proc. Am. Acad. 6 230 1864 is *simplicifol.*
Californicus [Gray] Greene Bull. Cal. Acad. 3 157 1885 No. 7
 A. collinus var. *Californicus* Gray Proc. Am. Acad. 12 54 1876
 Homalobus Californicus [Gray] Heller Muhl. 2 86 1906
calycosus Torr. in Bot. King. 66 and 435 t. 10 1871 No. 219
 A. brevicaulis Nelson Torr. Bull. 26 9 1899
 cyanoseminus Greene. Unpublished?
 Tragacantha calycosa [Torr.] Kuntze Rev. Gen. 2 943 1891
 Hamosa calycosa [Torr.] Rydberg Torr. Bull. 40 50 1913
 Var. *scaposus* [Gray] Jones Cont. 4 26 1893
 A. scaposus Gray Proc. Am. Acad. 13 366 1878
 candicans Greene Bull. Cal. Acad. 3 156 1885
 Hamosa scaposa [Gray] Rydberg Torr. Bull. 32 659 1905
campestris [Nutt.] Gray Proc. Am. Acad. 6 229 1864 No. 9
 Homalobus campestris Nutt. in T. & G. Fl. N. A. 1 351 1838
 camporum Rydberg Torr. Bull. 32 666 1905
 decumbens Gray Proc. Phil. Acad. Ser. 2 7 1863
 " Nutt. in T. & G. Fl. N. A. 1 352 1838 in part.
 tenuifolius " " " " " " "
 not tenuifolius Desf.
 decurrens Rydberg Torr. Bull. 31 563 1904
 oblongifolius " " " 34 50 1907
 Salidæ " " " 32 667 1905
 Tragacantha campestris [Nutt.] Kuntze Rev. Gen. 2 943 1891

- A. convallarius* Greene *Erythea* 1 207 1893
 decumbens var. *convallarius* (Greene) Jones *Cont.* 10 58, 69 1902
 Var. *crispatus* Jones
 Var. *decumbens* (Nutt.-Gray) Jones
A. decumbens Gray *Proc. Am. Acad.* 6 229 1864
Homalobus decumbens Nutt. in T. & G. *Fl. N. A.* 1 352 1838 part.
Phaca decumbens [Nutt.] Piper *Fl. Wash.* 373 1906
 Var. *hylophilus* (Rydberg) Jones
Homalobus hylophilus *Fl. Mont.* 247 1900
A. divergens Blankenship *Mont. Bot. Stud.* 1 73 1905
hylophilus (Rydberg) Nelson *Bot. Ry. Mts.* 291 1906
 Var. *serotinus* (Gray) Jones
A. serotinus Gray *Pac. R.R. Rep.* 12 18 51 t. 5 1890
 decumbens var. *serotinus* (Gray) Jones *Cont.* 10 58 1902
Palliseri Gray *Proc. Am. Acad.* 6 227 1864
strigosus C. & F. *Bot. Gaz.* 18 299 1893
griseopubens Sheldon *Minn. Bot. Stud.* 9 24 1894
Homalobus strigosus (C. & F.) Rydberg *Torr. Bull.* 40 53 1913
Palliseri (Gray) Rydberg *Fl. Mont.* 248 1900
serotinus (Gray) Rydberg " " "
campylophyllus Greene *Pitt.* 3 195 1897 is *Serenoi*
Canadensis L. 757 No. 128
Tragacantha Canadensis (L.) Kuntze *Rev. Gen.* 2 943 1891
Phaca Canadensis (L.) MacMillan *Metasperm.* 325 1894
 Var. *Carolinianus* (L.) Jones *Cont.* 7 647 1895
A. Carolinianus L. 757
 Var. *Mortoni* (Nutt.) Watson *Bot. King* 68 1871
A. Mortoni Nutt. *Jour. Phil. Acad.* 7 19 1834
tristis and *spicatus* Nutt. in T. & G. *Fl. N. A.* 1 336 1838
Candelarius Sheldon *Minn. Bot. Stud.* 9 142 1894 is *Newberryi* v'r
 Var. *exiguus* " " " " " 143 " " "
candicans Greene *Bull. Cal. Acad.* 3 156 1885 is *calycosus* var.
candidis-imus Watson *Bib. Index* 191 1878 is *Magdalenæ* Greene
Candollanus (H.B.K.) Sheldon *Minn. Bot. Stud.* 9 140 1894
 is *triflorus*
capillipes Jones No. 70
canonis Jones *Cont.* 8 15 1898 No. 111
carnosus Pursh *Fl.* 2 740 1814 is *crassicarpus*
Carolinianus L. 767 is *Canadensis* var.
caryocarpus Ker *Bot. Reg.* 2 t. 176 1816 is *crassicarpus*
Casei Gray *Bot. Cal.* 1 154 1876 No. 105
Tragacantha Casei (Gray) Kuntze *Rev. Gen.* 2 943 1891
castanæformis Watson *Proc. Am. Acad.* 20 361 8885 is *argophyllus*
 Var. *castanæformis*
Catalinensis Nutt. *Pl. Gambel* 152 1848 is *A. didymocarpus*
Cedrosensis Vasey & Rose *Cont. Nat. Herb.* 1 15 1893 is Nutt. var.
ceramicus Sheldon *Minn. Bot. Stud.* 9 19 1894 is *pictus*
cerussatus Sheldon *Minn. Bot. Stud.* 9 139 1894 is *triflorus*
Chætodon Torr. in Gray *Proc. Am. Acad.* 6 194 1864 is *Spaldingii*
Chamæleuce Gray *Bot. Ives* 10 1860 is *pygmæus*
Chandonettii Lunell *Am. Mid. Nat.* 2 127 1911 is *nitidus* var.
Chapalanus Jones No. 254
cicadæ Jones *Cont.* 4 35 1893 is *pygmæus*
cibarius Sheldon *Minn. Bot. Stud.* 9 146 1894 No. 162
A. arietinus Jones *Cont.* 7 653 1895
Xylophacos cibarius (Sheldon) Rydberg *Torr. Bull.* 40 48 1913
Cimensis Jones 122
circumdatus Greene *Pitt.* 1 173 1888 No. 92
Clevelandi Greene *Torr. Bull.* 9 121 1882 No. 264
Coahuilæ Jones No. 217
Cobrensis Gray *Pl. Wr.* 2 43 1853 No. 146
Tragacantha Cobrensis (Gray) Kuntze *Rev. Gen.* 2 943 1891
coccineus (Parry) Brandegee *Zoe* 2 72 1890 No. 177
A. Purshii var. *coccineus* Parry *West. Am. Sci.* 7 10 1890
Xylophacos coccineus [Parry] Heller *Muhl.* 2 217 1906
collinus Douglas in Hooker *Fl. Bor. Am.* 1 140 1830 No. 97
Phaca collina [Douglas] Hooker *Fl. Bor. Am.* 1 141 1830
Tragacantha collina [Dougl.] Kuntze *Rev. Gen.* 2 943 1891
Homalobus collinus [Dougl.] Rydberg *Torr. Bull.* 40 53 1913

- Var. Californicus Gray Proc. Am. Acad. 12 54 1876 is species
 Coltoni Jones Cont. 2 237 1891 No. 3
 Var. aphyllus Jones
 Var. Moabensis Jones Cont. 8 11 1898
 confertiflorus Gray Proc. Am. Acad. 13 368 1878 No. 201
 Cnemidophacos confetiflorus (Gyra) Rydberg Torr. Bull. 40 52 1913
 A. flavus var. candicans Gray Proc. Am. Acad. 12 54 1876
 Var. flaviflorus (Kuntze) Jones
 Tragacantha flaviflora Kuntze Rev. Gen. 2 941 1891
 A. flaviflorus (Kuntze) Sheldon Minn. Bot. Stud. 9
 158 1894
 A. flavus Nutt. in T. & G. Fl. N. A. 1 335 1838
 Congdoni Watson Proc. Am. Acad. 20 360 1885 No. 224
 conjunctus Watson Proc. Am. Acad. 18 371 1882 is revertus var.
 Var. oxytropidoides Jones Cont. 7 665 1895 " " "
 Var. Hoodianus (Howell) Jones Cont. 8 9 1898 " " "
 consectus Sheldon Minn. Bot. Stud. 9 143 1894 is Purshii var
 Xylophacos consectus (Sheldon) Rydberg Torr. Bull. 40 49 1913
 convallarius Greene Erythea 1 207 1893 is campestris
 Cooperi Gray Man. Ed. 2 98 1856 is neglectus
 coriaceous Hemsley Bot. Cent. Am. 1 263 1880 No. 156
 Tragacantha coriacea (Hemsley) Kuntze Rev. Gen. 2 943 1891
 Cottoni Jones No. 88
 A. Olympicus Cotton Torr. Bull. 35 573 1908
 Coulteri Benth. Pl. Hartw. 307 1848 is lentiginosus var.
 Craigi Jones Cont. 9 42 1900 No. 79
 Crandallii Gandoger Bull. Soc. France 48 14 1902 ?
 crassicarpus Nutt. in Fraser's Cat. of 1813 No. 196
 A. carnosus Pursh Fl. 2 740 1814
 caryocarpus Ker in Bot. Reg. 2 t. 176 1816
 succulentus Rich. in Frankl. Jour. Supp. 18 1823
 prunifer Rydberg Fl. Mont. 239 1900
 Phaca caryocarpa (Ker) MacMillan Metasperm. 326 1892
 Geoprimum crassicarpum (Nutt.) Rydberg in Small's Fl. 616 190
 succulentum (Rich.) Rydberg Torr. Bull. 32 658 1906
 Var. pachycarpus [T. & G.] Jones Cont. 8 16 1898
 A. pachycarpus T. & G. Fl. N. A. 1 332 1838
 Geoprimum pachycarpum (T. & G.) Rydberg in Small's Fl. l. c.
 crescenticarpus Sheldon Minn. Bot. Stud. 9 148 1894 is amphioxy
 Crotalariae (Benth.) Gray Proc. Am. Acad. 6 216 1864 No. 57
 Phaca Crotalariae Benth. Pl. Hartw. 307 1848
 Tragacantha Crotalariae (Benth.) Kuntze Rev. Gen. 2 943 1891
 Var. anemophilus (Greene) Jones Cont. 10 59 1902 is vestitus
 Var. Magdalenae (Greene) Jones Cont. 10 59 1902 is species
 Var. Menziesii (Gray) Jones Cont. 10 59 1902 is vestitus var.
 Var. virgatus Gray Bot. Cal. 1 149 1876 is vestitus var.
 curtiflorus (Rydberg) Jones Cont. 10 64 1902 is elegans var.
 curtipes Gray Proc. Am. Acad. 6 217 1864 No. 72
 A. leucopsis var. curtipes (Gray) Jones Cont. 10 62 1902 is species
 Tragacantha curtipes (Gray) Kuntze Rev. Gen. 2 943 1891
 Cusickii Gray Proc. Am. Acad. 13 370 1878 No. 66
 Phaca Cusickii [Gray] Torr. Bull. 40 47 1913
 Cusickii Rydberg Torr. Bull. 26 541 1899 is arrectus
 cuspidocarpus Sheldon Minn. Bot. Stud. 9 147 1894 is Missourien.
 cyaneus Gray Pl. Fend. 34 1849 is Shortianus var.
 cyanoseminus Greene unpub. ? is calycosus
 cymatodes Greene Pitt. 3 196 1897 is accidens var.
 cymboides Jones Cont. 7 650 1895 No. 172
 Xylophacos cymboides [Jones] Rydberg Torr. Bull. 40 49 1913
 cyrtoides Gray Proc. Am. Acad. 6 201 1864 is collinus
 Daleae Greene Pitt. 1 153 1888 is vaccarum
 debilis Walp. Rep. 1 710 1842 is miser
 debilis [Nutt.] Gray Proc. Phil. Acad. Series 2 7 60 1863 No. 27
 Phaca debilis Nutt. in T. & G. Fl. N. A. 1 345 1838
 Tragacantha debilis [Nutt.] Kuntze Rev. Gen. 2 943 1891
 Homalobus debilis [Nutt.] Rydberg Torr. Bull. 40 53 1913
 A. Bodini Sheldon Minn. Bot. Stud. 9 122 1894
 Phaca Bodini [Sheldon] Rydberg Torr. Bull. 32 665 1905

- decumbens (Nutt.) Gray Proc. Am. Acad. 6 229 1864 is campestris
 Tragacantha decumbens (Nutt.) Kuntze Rev. Gen. 2 943 1891
 Var. convallarius (Greene) Jones is campestris var. See.
 Var. serotinus (Gray) Jones is campestris var. “
- demissus Greene Erythea 1 221 1893 is Haydenianus
 densifolius (Smith) Torr. Pac. R.R. Rep. 7 10 1856 is vestitus var.
 desperatus Jones Zoe 2 243 1891 No. 164
 A. arietinus var. stipularis Jones Cont. 7 655 1895
 Tium desperatum (Jones) Rydberg Torr. Bull. 32 660 1905
 detritalis Jones Cont. 13 9 1910 No. 15
 diaphanus Douglas in Hooker Fl. Bor. Am. 1 151 1834 is
 lentiginosus var.
- didymocarpus H. & A. Bot. Beech. 334 t. 81 1840 No. 269
 A. Catalinensis Nutt. Pl. Gambel 152 1848
 Hesperastragalus (H. & A.) Heller Muhl. 2 87 1905
 Diehlii Jones No. 154
- diphacus Watson Proc. Am. Acad. 17 342 1882 No. 271
 Var. peonis Jones Cont. 10 65 1902
- diphysus Gray Pl. Fend. 34 1849 is lentiginosus var. diphysus
 Var. latus Jones Cont. 3 287 1893 is lentiginosus var. latus
 Var. albiflorus Gray Pl. Fend. 34 1849 is Pattersoni
- dispermus Gray Proc. Am. Acad. 13 365 1878 No. 270
 Hesperastragalus dispermus (Gray) Heller Muhl. 1 137 1906
 compactus “ “ 2 218 “
- distortus T. & G. Fl. N. A. 1 333 1838 No. 215
 Tragacantha distorta (T. & G.) Kuntze Rev. Gen. 2 943 1891
 Var. Engelmanni (Sheldon) Jones
 A. Engelmanni Sheldon Minn. Bot. Stud. 9 152 1894
 A. flagellaris Eng. in herb.
- diurnus Watson Proc. Am. Acad. 21 450 1886 No. 34
- divergens Blankenship Mont. Bot. Stud 1 73 1905 is campestris var.
 Homalobus divergeas (Blankenship) Rydberg Torr. Bull. 34 417 1907
- diversifolius Gray Proc. Am. Acad. 6 230 1864 is junceus var.
 Dodgeanus Jones Cont. 3 289 1893 is Wingatensis var.
- dorychnio lies Douglas in G. Don's Syst. Gard. & Bot. 2 258 1834 is
 A. succumbens
- Douglasii (T. & G.) Gray Proc. Am. Acad. 6 215 1864 No. 62
 Phaca Douglasii T. & G. Fl. N. A. 1 346 1838
 Tragacantha Douglasii (T. & G.) Kuntze Rev. Gen. 2 943 1891
 Var. glaberrimus Jones Cont. 7 645 1895
 Var. Parishii (Gray) Jones Cont. 8 6 1898
 A. Parishii Gray Proc. Am. Acad. 19 75 1833
 Var. piscinus Jones Cont. 7 645 1895 (as species) and 10 61 1902
 Var. Tejonensis Jones Cont. 7 644 1895 as species and 10 61 1902
 Phaca Tejonensis (Jones) Heller Muhl. 2 85 1906
- drepanolobus Gray Proc. Am. Acad. 19 75 1883 No. 223
 Var. aberrans Jones Cont. 10 64 1902 is Howellii var. misellus
- Drummondii Douglas in Hooker Fl. Bor. Am. 1 153
 t. 57 1834 No. 210
 Tragacantha Drummondii (Douglas) Kuntze Rev. Gen. 2 943 1891
 Tium Drummondii [Douglas] Rydberg Torr. Bull. 32 659 1905
- Duchesnensis Jones Cont. 13 9 1910 No. 213
- Eastwoodæ Jones Cont. 5 368 1894 is Preussii var.
 Phaca Eastwoodæ [Jones] Rydberg Torr. Bull. 32 664 1906
- elaticarpus Sheldon Minn. Bot. Stud. 9 20 1894 is lotiflorus var.
- elegans [Hook.] Sheldon Minn. Bot. Stud. 9 154 1894 No. 85
 Phaca elegans Hooker Fl. Bor. Am. 1 144 1830
 Var. minor “ “ “ “ “ “ “ “
- Atelophragma elegans [Hook.] Rydberg Torr. Bull. 32 660 1905
 Astragalus minor [Hook.] Jones Cont. 10 64 1902
 oroboides var. Americanus Gray Proc. Am. Acad. 6 205 1864
 Shearii Rydberg Torr. Bull. 31 562 1894
- Var. curtiflorus [Rydberg] Jones
 A. curtiflorus Rydberg Fl. Mont 242 1900
 Phaca parviflora Nutt. in T. & G. Fl. N. A. 1 348 1838
- Elmeri Greene Erythea 3 98 1895 is nigrescens
 Engelmann Sheldon Minn. Bot. Stud. 9 152 1894 is distortus var.
 Elliottii Dietr. Syn. Pl. 4 1080 1850 is obcordatus

ensiformis Jones Cont. 7 658 1895 No. 184
Episcopus watson Proc. Am. Acad. 10 346 1875 No. 12
Homalobus Episcopus (Watson) Rydberg Torr. Bull. 40 53 1913
eremicus Sheldon in Death Val. Rep. 86 1893 is *lentiginosus* var.
eremiticus Sheldon Minn. Bot. Stud. 9 161 1894 is *arrectus* var.
eriocarpus Watson Bot. King 71, 440 1871 is *Newberryi* var.
ervoides H. & A. Bot. Beech. 417 1841 No. 245
apertus Sheldon Minn. Bot. Stud. 9 166 1894
Tepicus " " " " " 172 "
Hookerianus Dietr. Syn. Pl. 4 1086 1850
Tragacantha ervoides (H. & A.) Kuntze Rev. Gen. 2 943 1891
Esperanzæ Jones No. 253
Eurekaensis Jones Cont. 8 12 1898 and 3 291 No. 176
exilifolius Nelson Torr. Bull. 26 10 1899 is *simplicifolius* var.
fallax watson Proc. Am. Acad. 20 362 1885 is *gracilentus* var.
famelicus Sheldon Minn. Bot. Stud. 9 23 1894 is *gracilentus* var.
fastidiosus Greene Bull. Cal. Acad. 1 186 1885 is *leucopsis* var.
fastidius (Kellogg) Jones Cont. 8 7 1898 is *leucopsis* var.
Feensis Jones Cont. 8 20 1898 No. 183
Fendleri Gray Pl. Wr. 44 1853 is *flexuosus* var.
filifolius Gray Pac. R.R. Rep. 12 42 1860 is *pictus* var.
filipes Torr. Bot. Wilkes 278 1854 is *stenophyllus*
flagellaris Eng. in Sheldon Minn. Bot. Stud. 9 152 1894 is *distort* v
flaviflorus (Kuntze) Sheldon Minn. Bot. Stud. 9 158 1894 is
confertiflorus var.
flavus Nutt. in T. & G. Fl. N. A. 1 335 1838 is *confertiflorus* var.
Cnemidophacos flavus (Nutt.) Rydberg Torr. Bull. 32 664 1905
flexuosus Douglas in Hooker Fl. Bor. Am. 1 140 1830 No. 153
Phaca flexuosa (Douglas) Hooker Fl. Bor. Am. 1 141 1830
Tragacantha flexuosa (Douglas) Kuntze Rev. Gen. 2 943 1891
Homalobus flexuosus (Dougl.) Rydberg Torr. Bull. 32 666 1905
 Var. *Fendleri* (Gray) Jones Cont. 10 62 1902
A. Fendleri Gray Pl. Wright. 2 44 1853
Phaca Fendleri Gray Pl. Fend. 36 1849
Homalobus Fendleri (Gray) Rydberg Torr. Bull. 32 667 1905
Salidæ Rydberg Torr. Bull. 32 667 1905
Tragacantha Fendleri (Gray) Kuntze Rev. Gen. 2 943 1891
 Var. *Diehlii* Jones
 Var. *elongatus* (Hook.) Jones
Phaca elongata Hooker Fl. Bor. Am. 1 141 1830
foliolosus (Gray) Sheldon Minn. Bot. Stud. 9 9 138 1894 si *pictus*
A. pictus var. *foliolosus* Gray Proc. Am. Acad. 6 215 1864
Forwoodii Watson Proc. Am. Acad. 25 129 1890 is *aboriginum* var.
Franciscanus Sheldon Minn. Bot. Stud. 9 135 1894 is *vestitus* var.
Francisquitensis Jones Cont. 7 666 1895 No. 234
 Var. *Lagunensis* Jones Cont. 8 11 as species and 10 61 1902
Fremotii T. & G. Pac. R. R. Rep. 4 80 1857 is *lentiginosus* var.
frigidus (L.) Gray Proc. Phil. Acad. Ser. 2 7 60 1863 is *alpinus*
Tragacantha frigida (L.) Kuntze Rev. Gen. 2 943 1891
Funereus Jones Cont. 12 11 1908 No. 178
galegioides Nutt. Gen. 2 100 1818 is *racemosus*
Gambellianus Sheldon Minn. Bot. Stud. 9 21 1894 is *nigrescens*
gaviotus Elmer Bot. Gaz. 39 54 1905 is *Antiselli* var.
Gertrudis Greene Leaflets 2 43 1910 is *gracilentus* var.
Geyeri Gray Proc. Am. Acad. 6 214 1864 No. 38
Phaca annua Geyer in Hook. Lond. Jour. Bot. 6 213 1847
Tragacantha Geyeri (Gray) Kuntze Rev. Gen. 2 943 1891
 Var. *triquetrus* (Gray) Jones Cont. 8 7 1898 is *triquetrus*
Gibbsii Kellogg Proc. Cal. Acad. 2 161 t. 50 1863 No. 98
Tragacantha Gibbsii (Kellogg) Kuntze Rev. Gen. 2 943 1891
 Var. *curvicarpus* [Sheldon] Jones Cont. 10 62 1902
A. speirocarpus var. *curvicarpus* Sheldon Minn. Bot. Stud. 9
 125 1894
 Var. *falciformis* Gray Bot. Cal. 1 152 1876
sinuatus Piper Torr. Bull. 28 40 1601
Homalobus curvicarpus [Sheldon] Heller Muhl. 2 86 1906
 Var. *falciformis* [Gray] Jones Cont. 8 23 1898 is var. *curvicarpus*

giganteus (Pall.) Sheldon Minn. Bot. Stud. 9 154 1894 is *oroboides*
giganteus Watson Proc. Am. Acad. 17 370 1882 No. 192
A. Texanus Sheldon Minn. Bot. Stud. 9 141 1894
 Var. *Yaquianus* (Watson) Jones
A. Yaquianus Watson Proc. Am. Acad. 23 270 1888
Gilensis Greene Torr. Bull. 8 97 1881 No. 20
gilviflorus Sheldon Minn. Bot. Stud. 9 21 1894 is *triphyllus*
glaber Michaux Fl. 2 66 1803 No. 216
Tragacantha Michauxii Kuntze Rev. Gen. 2 943 1891
apilosus Sheldon Minn. Bot. Stud. 9 22 1894
glabriusculus (Hook.) Gray Proc. Am. Acad. 6 204 1864 is *aborig. v*
Tragacantha glabriuscula (Hook.) Kuntze Rev. Gen. 2 943 1891
Phaca glabriuscula Hooker Fl. Bor. Am. 1 144 1830
Atelophragma glabriusculum Rydberg Torr. Bull. 32 660 1905
glareosus Douglas in Hooker Fl. Bor. Am. 1 152 1834 is
inflexus var.
Goldmani Jones No. 263
goniatus Nutt. in T. & Fl. N. A. 1 330 1838 is *agrestis*
Gormani Wight No. 84
gracilentus Gray Pl. Fend. 36 1849 as *Phaca* No. 155
 Gray Proc. Am. Acad. 6 223 1864
Neomexicanus Wooton & Standley Cont. Nat. Herb. 16 37 1913
Tragacantha gracilenta (Gray) Kuntze Rev. Gen. 2 943 1891
 Var. *exsertus* Jones
 Var. *fallax* (Watson) Jones Cont. 8 14 1898
A. fallax Watson Proc. Am. Acad. 20 362 1885
famelicus Sheldon Minn. Bot. Stud. 9 23 1894
Gertrudis Greene Leaflets 2 43 1910
 Var. *Greenei* (Gray) Jones Cont. 8 14 1898
A. Greenei Gray Proc. Am. Acad. 16 105 1880
 Var. *Hallii* (Gray) Jones Cont. 8 13 1898
A. Hallii Gray Proc. Am. Acad. 6 224 1864
Homalobus Hallii (Gray) Rydberg Torr. Bull. 32 667 1905
gracilis Nutt. Gen. 2 100 1818 is *parviflorus*
Microphacos gracilis (Nutt) Rydberg Torr. Bull. 32 663 1905
grallator Watson Zoe 3 52 1892 is *Haydenianus*
Homalobus grallator (Watson) Rydberg Torr. Bull. 32 666 1905
grandiflorus Watson Proc. Am. Acad. 17 370 1882 is *coccineus*
Grayi Parry Am. Nat. 8 212 1874 No. 103
Tragacantha Grayi (Parry) Kuntze Rev. Gen. 2 943 1891
Ctenophyllum Grayi (Parry) Rydberg Torr. Bull. 40 50 1913
Greenei Gray Proc. Am. Acad. 16 105 1880 is *gracilentus* var.
Greggii Watson Proc. Am. Acad. 17 343 1882 No. 246
griseopubens Sheldon Minn. Bot. Stud. 9 24 1894 is *campestris*
Guatamalensis Hemsley Bot. Cent. Am. 1 264 1880 No. 147
 Var. *Oaxacanus* (Rose as species) in Jones Cont. 8 9 1898
Hallii Gray Proc. Am. Acad. 6 224 1864 is *gracilentus* var.
Homalobus Hallii (Gray) Rydberg Torr. Bull. 32 667 1905
Hartwegi Benth. Pl. Hartw. 10 1839 No. 256
Tragacantha Hartwegi (Benth.) Kuntze Rev. Gen. 2 943 1891
Hasseanus Sheldon Minn. Bot. Stud. 9 124 1894 is *Antiselli* var.
Haydenianus Gray in Brandegee's Rep. Col. 235 1876 No. 205
Tragacantha Haydeniana (Gray) Kuntze Rev. Gen. 2 943 1891
Diholcus Haydenianus (Gray) Rydberg Torr. Bull. 32 664 1905
 Var. *major* and *Nevadensis* Jones Zoe 2 241 1891 are not distinct
A. scobinatulus Sheldon Minn. Bot. Stud. 9 24 1894
demissus Greene Erythea 1 221 1893
Jepsoni Sheldon Minn. Bot. Stud. 9 22 1894
grallator Watson Zoe 3 52 1892
Homalobus grallator (Watson) Rydberg Torr. Bull. 32 666 1905
Helleri Fenzl. Bonplandia 8 56 1861 is *nomen nudum*.
Hendersoni Watson Proc. Am. Acad. 22 471 1887 is *accidens* var.
holosericeus Jones Cont. 7 638 1895 is *macrodon*
Hoodianus Howell Erythea 1 111 1893 is *reventus* var.
Hookerianus Dietr. Syn. Pl. 4 1086 1850 is *ervoides*

- Hookerianus (T. & G.) Gray Proc. Am. Acad. 6 215 1864 No. 67
 Phaca Hookeriana T. & G. Fl. N. A. 1 693 1840
 Tragacantha Hookeriana (T. & G.) Kuntze Rev. Gen. 2 943 1891
 A. Sonneanus Greene Pitt. 3 186 1897
 Var. Whitneyi (Gray) Jones Cont. 7 668 1895
 A. Whitneyi Gray Proc. Am. Acad. 6 526 1865
 Var. pinonis Elmer Bot. Gaz. 39 54 1905
 Hornii Gray Proc. Am. Acad. 7 398 1868 No. 46
 Tragacantha Hornii (Gray) Kuntze Rev. Gen. 2 943 1891
 Var. Bahaensis (Sheldon) Jones Cont. 10 62 1902
 A. Bahaensis Sheldon Minn. Bot. Stud. 9 169 1894
 Var. minutiflorus Jones Cont. 7 677 1895
 Hosackiæ Greene Bull. Cal. Acad. 3 157 1885 is humistratus var.
 Howellii Gray Proc. Am. Acad. 15 46 1879 No. 228
 Var. misellus (Watson) Jones
 A. misellus Watson Proc. Am. Acad. 21 449 1886
 Humboldtii Gray Proc. Am. Acad. 6 195 1864 No. 190
 Phaca mollis H.B.K. Nov. Gen. & Sp. 6 496 1824
 Tragacantha mollis (H.B.K.) Kuntze Rev. Gen. 2 943 1891
 humilis Geyer in Hook. Lond. Jour. Bot. 6 211 1847 is Geyeri
 humillimus Gray in Brandegees' Rep. Col. 235 1876 No. 19
 Tragacantha humillima (Watson) Kuntze Rev. Gen. 2 943 1891
 Phaca humillima (Watson) Rydberg Torr. Bull. 33 665 1905
 humistratus Gray Pl. Wr. 2 43 1853 No. 17
 Tragacantha humistrata (Gray) Kuntze Rev. Gen. 2 943 1891
 Tium humistratum (Gray) Rydberg Torr. Bull. 32 660 1905
 A. albulus Wootton & Standley Cont. Nat. Herb. 16 136 1913
 Var. Hosackiæ (Greene) Jones Cont. 10 58 1902
 A. Hosackiæ Greene Bull. Cal. Acad. 3 157 1885
 Var. Sonoræ (Gray) Jones Cont. 10 58 1902
 A. Sonoræ Gray Pl. Wr. 2 44 1853
 Var. tenerrimus Jones Cont. 7 649 1895
 hyalinus Jones Cont. 7 648 1895 No. 25
 hylophilus (Rydberg) Nelson Bot. Ry. Mts. 291 1909 is campestris var.
 Hypoglottis L. Mantissa 275 1767 is not American
 Phaca Hypoglottis (L.) MacMillan Metasperm. 325 1892
 Tragacantha Hypoglottis (L.) Kuntze Rev. Gen. 2 943 1891
 Var. bracteatus Osterhout Torr. Bull. 26 256 1899 is agrestis var.
 Var. polyspermus T. & G. Fl. N. A. 1 328 1838 is " "
 A. virgultulus Sheldon Minn. Bot. Stud. 9 165 1894
 Var. robustior Hook. Lond. Jour. Bot. 6 210 1847 is nitidus
 Var. strigosus Kell. Proc. Cal. Acad. 2 115 1863 is tener
 hypoleucus Schauer Linnæa 20 747 1847 No. 260
 Tragacantha hypoleuca (Schauer) Kuntze Rev. Gen. 2 943 1891
 hypoxylus Watson Proc. Am. Acad. 18 192 1883 No. 255
 Ibapensis Jones Cont. 3 290 1893 No. 139
 Atelophragma Ibapensis [Jones] Rydberg Torr. Bull. 40 51 1913
 ineptus Gray Proc. Am. Acad. 6 525 1865 is lentiginosus var.
 inflexus Douglas in Hooker Fl. Bor. Am. 1 151 1834 No. 180
 Xylophacos inflexus [Douglas] Rydberg Torr. Bull. 40 49 1913
 Var. glareosus [Douglas] Jones Cont. 10 62 1902
 A. glareosus Douglas in Hooker Fl. Bor. Am. 1 152 1834
 allanaris Sheldon Minn. Bot. Stud. 9 141 1894
 Booneanus Nelson Bot. Gaz. 53 223 1912
 Tragacantha glareosa [Douglas] Kuntze Rev. Gen. 2 943 1891
 insularis Kell. Bull. Cal. Acad. 1 6 1884 No. 47
 triflorus var. insularis [Kellogg] Jones Cont. 6 637 1895
 Var. Pondii [Greene] Jones
 A. Pondii Greene Pitt. 1 288 1889
 Var. Quentinus Jones Cont. 8 6 1898
 intermedius Jones Cont. 7 656 1895 is Phœnicis
 intonsus Sheldon Minn. Bot. Stud. 9 23 1894 is villosus
 inversus Jones Cont. 5 276 1893 No. 8
 Inyoensis Sheldon in Coville's Death Valley Rep. 86 1893 No. 230
 iodanthus Watson Bot. King 70 1871 No. 163
 Tragacantha iodantha [Watson] Kuntze Rev. Gen. 2 943 1891
 iodopetalus Greene in herb. is Shortianus

- jejunos* Watson Bot. King 73 1871 No. 65
Tragacantha jejuna (Watson) Kuntze Rev. Gen. 2 943 1891
Phaca jejuna (Watson) Rydberg Torr. Bull. 40 48 1913
Jepsoni Suedon Minn. Bot. Stud. 9 22 1894 is *Haydenianus*
Jesupi (Eggleston & Sheldon) Britton Man. 1048 1901 is *Labradoricus*
Julianus Jones Cont. 7 667 1895 No. 39
Junceus (Nutt.) Gray Proc. Am. Acad. 6 230 1864 No. 11
Homalobus junceus Nutt. in T. & G. Fl. N. A. 1 351 1838
A. diversifolius var. *junceus* (Nutt.) Jones Cont. 8 13 1898
 Var. *roborum* Jones Cont. 10 61 1902
 Var. *diversifolius* (Gray) Jones
A. diversifolius Gray Proc. Am. Acad. 6 230 1864
junciformis Nelson Torr Bull. 26 9 1899
Homalobus orthocarpus Nutt. in T. & G. Fl. N. A. 1 351 1838
junciformis (Nelson) Rydberg Torr. Bull. 32 667 1905
 Var. *attenuatus* Jones
Kaibensis Jones Cont. 10 64 1902 No. 211
Kelseyi Rydberg Fl. Mont. 241 1900 is *arrectus* var.
Kentrophyta Gray Proc. Phil. Acad. Ser. 2 7 60 1863 is *montanus*
Lagunensis Jones Cont. 8 11 1898 is *Francisquitensis* var.
Labradoricus DC. Prod 2 287 1825 No. 86
secundus Michaux Fl. 2 66 1803
Blakei Eggleston Bot. Gaz. 20 271 1895
Robbinsii var. *Jesupi* Egg.-Sheldon Minn. Bot. Stud. 9 155 1894
 var. *borealis* Eggleston Bot. Gaz. 20 271 1895
Jesupi (Eggleston & Sheldon) Britton Man. 1048 1901
 Var. *Robbinsii* (Oakes) Jones
A. " " in Gray's Man. Ed. 2 98 1856
Phaca " Oakes in Hovey's Mag. 7 179 1841
 Var. *occidentalis* (Watson) Jones
A. Robbinsii var. *occidentalis* Watson Bot. King 70 1871
occidentalis (Watson) Jones Cont. 8 17 1898
Macounii Rydberg Fl. Mont. 243 1900 is an intergrade
Atelophragma Macounii Rydberg Torr. Bull. 32 660 1905
Homalobus Clementis Rydberg Torr. Bull. 31 563 1904
lancearius Gray Proc. Am. Acad. 13 370 1878 No. 12
Homalobus lancearius (Gray) Rydberg Torr. Bull. 40 52 1913
lanocarpus Sheldon Minn. Bot. Stud. 9 144 1894 is *Purshii*
latus Jones Zoe 3 287 and 4 272 1893 is *lentiginosus* var.
Layneæ Greene Bull. Cal. Acad. 3 156 1885 No. 186
A. malacus var. *Layneæ* (Greene) Jones Cont. 4 29 1893
lectulus Watson Proc. Am. Acad. 22 471 1887 is *Purshii* var.
Leibergi Jones Cont. 7 663 1895 is *arrectus* var.
Lemmoni Gray Proc. Am. Acad. 8 626 1873 No. 252
Tragacantha Lemmoni (Gray) Kuntze Rev. Gen. 2 943 1891
lentiformis Gray Bot. Cal. 1 156 1876 No. 243
Tragacantha lentiformis (Gray) Kuntze Rev. Gen. 2 943 1891
lentiginosus Douglas in Hooker Fl. Bor. Am. 1 151 1834
 No. 80
Tragacantha lentiginosa (Douglas) Kuntze Rev. Gen. 2 943 1891
Cystium lentiginosum (Douglas) Rydberg Torr. Bull. 40 50 1913
Phaca lentiginosa (Douglas) Piper Fl. Wash. 368 1906
A. lentiginosus var. *floribundus* Gray Proc. Am. Acad. 6 525
 1865
salinus Howell Erythraea 1 111 1893
 Var. *albifolius* Jones
 Var. *Borreganus* Jones Cont. 8 3 1898
 Var. *carinatus* Jones
 Var. *chartaceus* Jones Cont. 7 673 1895 is var. *diphysus*
 Var. *Coulteri* [Benth.] Jones Cont. 8 4 1898
A. Coulteri Benth. Pl. Hartw. 307 1848
Arthu-Schottii Gray Proc. Am. Acad. 6 209 1864
Tragacantha Coulteri [Benth.] Kuntze Rev. Gen. 2 943 1891
Cystium Coulteri [Benth.] Rydberg Torr. Bull. 40 50 1913
 Var. *cuspidocarpus* [Sheldon] Jones Cont. 7 673 1895 is *Missouriensis*
 Var. *diaphanus* [Douglas] Jones Cont. 7 675 1895
A. diaphanus Douglas in Hooker Fl. Bor. Am. 1 151 1834

- Var. *diphysus* (Gray) Jones Cont. 7 673 1895
 A. diphysus Gray Pl. Fend. 34 1849
 Var. *chartaceus* Jones Cont. 7 673 1895
 Var. *floribundus* Gray Proc. Am. Acad. 6 525 1865 is *lentiginosus*
 Var. *Fremonti* (T. & G.) Watson Bot. King 66 1871
 A. Fremonti T. & G. Pac. R. R. Rep. 4 80 1857
 Coulteri var. *Fremonti* (T. & G.) Jones Cont. 7 669 1895
 Var. *Idriensis* Jones Cont. 10 63 1902
 Var. *ineptus* (Gray) Jones
 A. ineptus Gray Proc. Am. Acad. 525 1865
 Phaca inepta (Gray) Rydberg Fl. Mont. 246 1900
 Cystium ineptum (Gray) Rydberg Torr. Bull. 32 659 1905
 Var. *latus* Jones Zoe 3 387 1893 as *diphysus* var., and 4 272 1893
 as species, and Cont. 7 675 1895
 Var. *MacDougali* (Sheldon) Jones Cont. 7 673 1895
 A. MacDougali Sheldon Minn. Bot. Stud. 9 169 1894
 Var. *Mokiacensis* (Gray) Jones
 A. Mokiacensis Gray Proc. Am. Acad. 13 367 1878
 ursinus Gray l. c.
 Wilsoni Greene Pitt. 3 196 1897
 Var. *nigricalycis* Jones Cont. 7 674 1895
 Var. *palans* Jones Cont. 4 37 1893 as species and 8 4 1898
 A. araneosus Sheldon Minn. Bot. Stud. 9 170 1894
 palans var. *araneosus* (Sheldon) Jones Cont. 7 675 1895
 Cystium araneosum (Sheldon) Rydberg Torr. Bull. 40 50 1913
 Var. *Sierræ* Jones
 Var. *scorpionis* Jones
 Var. *Yuccanus* Jones Cont. 8 3 1898
leptaleus Gray Proc. Am. Acad. 6 220 1864 No. 30
 Phaca leptalea (Gray) Rydberg Torr. Bull. 40 48 1913
 pauciflora Nutt. in T. & G. Fl. N. A. 1 348 1838
 A. pauciflorus (Nutt.) Gray Proc. Phil. Acad. Ser. 2 7 50 1863
leptophyllus Nutt. Jour. Phil. Acad. 7 18 1834 is *stenophyllus*
leptocarpus T. & G. Fl. N. A. 1 334 1838 No. 236
 Hamosa leptocarpa (T. & G.) Rydberg in Small's Fl. S. E. U. S. 617,
 1332 1903
 macilenta Rydberg l. c.
leucocystis Greene Erythea 3 76 1895 is *Purshii*
leucophyllus Hook. Jour. Bot. 6 211 1847 is *arrectus*
leucophyllus T. & G. Fl. N. A. 1 336 1838 No. 71
 Phaca leucophylla (T. & G.) H. & A. Bot. Beech. 333 1841
 Tragacantha leucophylla (T. & G.) Kuntze Rev. Gen. 2 943 1891
 A. asymmetricus Sheldon Minn. Bot. Stud. 9 23 1894
 leucopsis var. *asymmetricus* (Sheldon) Jones Cont. 10 62 1902
 Var. *leucophyllus* (T. & G.) Jones Cont. 8 23 1898
leucopsis [T. & G.] Torr. Mex. Bound. 56 t 16 1859 No. 73
 Phaca leucopsis T. & G. Fl. N. A. 1 694 1840
 canescens Nutt. in T. & G. Fl. N. A. 1 351 1838
 Tragacantha leucopsis [T. & G.] Kuntze Rev. Gen. 2 946 1891
 Var. *brachypus* Greene Pitt. 1 33 1887 is var. *fastidius*
 Var. *curtipes* [Gray] Jones Cont. 10 62 1902 is *curtipes*
 Var. *curtus* Sheldon Minn. Bot. Stud. 9 134 1894 is *fastidius*
 Var. *fastidius* [Kell.] Jones Cont. 10 62 1902
 Phaca fastidia Kellogg Hesperian 4 145 1860
 A. fastidiosus Greene Bull. Cal. Acad. 1 186 1885
 Var. *leucophyllus* [T. & G.] Jones Cont. 8 22 1898 is *leucophyllus*
 Var. *lonchus* Jones
limatus Sheldon Minn. Bot. Stud. 9 126 1894 No. 115
Lindheimeri Gray Pl. Wr. 1 52 1852 No. 235
 Tragacantha Lindheimeri [Gray] Kuntze Rev. Gen. 2 946 1891
 Hamosa Lindheimeri [Gray] Rydberg in Small's Fl. S. E. U. S. 617,
 1332 1903
 A. reticarpus Wood Bot. Gaz 3 50 1878
lingulatus Sheldon Minn. Bot. Stud. 9 118 1894 is *simplicifolius*

- onchocarpus* Torr. Pac. R. R. Rep. 4 80 1857 No. 214
Phaca macrocarpa Gray Pl. Fend. 36 1849
Homalobus macrocarpus (Gray) Rydberg Torr. Bull. 32 667 1905
Tragacantha macrocarpa (Gray) Kuntze Rev. Gen. 2 946 1891
A. macer Nelson Bot. Gaz. 56 65 1913
lotiflorus Hooker Fl. Bor. Am. 1 152 1834 No. 95
Phaca lotiflora (Hooker) T. & G. Fl. N. A. 1 349 1838
Tragacantha lotiflora (Hooker) Kuntze Rev. Gen. 2 943 1891
 Var. *brachypus* Gray Proc. Am. Acad. 6 209 1864 is *lotiflorus*
A. elatiocarpus Sheldon Minn. Bot. Stud. 9 20 1894
 ammolotus Greene Erythea 3 76 1895
Phaca elatiocarpa (Sheldon) Rydberg Torr. Bull. 32 665 1905
 Var. *Nebraskensis* Bates Am. Nat. 29 670 1895 is var. *Reverchoni*
A. Nebraskensis Bates Torreyia 5 216 1905
 Var. *Reverchoni* (Gray) Jones Cont. 10 62 1902
A. Reverchoni Gray Proc. Am. Acad. 19 75 1883
 Nebraskensis Bates Torreyia 5 216 1905
 Batesii Nelson Bot. Gaz. 54 150 1912
Phaca cretacea Buckley Proc. Phil. Acad. Ser. 2 5 452 1861
 Reverchoni (Gray) Rydberg in Small's Fl. S. E. U. S. 619 1903
lutosus Jones Cont. 13 7 1910 No. 74
Luisianus Jones No. 247
Lyallii Gray Proc. Am. Acad. 6 195 1864 No. 135
Tragacantha Lyallii (Gray) Kuntze Rev. Gen. 2 943 1891
MacDougali Sheldon Minn. Bot. Stud. 9 169 1894 is *lentiginosus* v
macer Nelson Bot. Gaz. 56 65 1913 is *lonchocarpus*
Macounii Rydberg Fl. Mont. 243 1900 is *Labradoricus* var.
macrodon (H. & A.) Gray Proc. Am. Acad. 6 216 1864 No. 61
Phaca macrodon H. & A. Bot. Beech. 333 1841
Tragacantha macrodon (H. & A.) Kuntze Rev. Gen. 2 943 1891
A. holosericeus Jones Cont. 7 638 1895
Madrensis Jones No. 244
Magdalenæ Greene Pitt. 1 162 1888 No. 59
Phaca candidissima Benth. Bot. Sulph. 13 1845
A. candidissimus (Benth.) Watson Bib. Index 191 1878
 Crotalariae var. *Magdalenæ* (Greene) Jones Cont. 10 59 1902
malacus Gray Proc. Am. Acad. 7 336 1868 No. 185
Tragacantha malaca (Gray) Kuntze Rev. Gen. 2 946 1891
A. obfalcatus Nelson Bot. Gaz. 54 411 1912
 Var. *Layneæ* (Greene) Jones Cont. 4 29 1393 is *Lasneæ*
malacus x *Layneæ* Jones
Malheurenensis Heller Muhl. Cat. Ed. 2 7 1900 is *arrectus*
Matthewsii Watson Proc. Am. Acad. 18 192 1883 is *Bigelovii* var.
megacarpus (Nutt.) Gray Proc. Am. Acad. 6 215 1864 No. 75
Phaca megacarpa Nutt. in T. & G. Fl. N. A. 1 343 1838
Tragacantha megacarpa (Nutt.) Kuntze Rev. Gen. 2 943 1891
 Var. *caulescens* Jones Cont. 7 643 1895 is *oophorus*
 Var. *Parryi* Gray Bot. Cal. 1 148 1876
 Var. *prodigus* Sheldon Minn. Bot. Stud. 9 136 1894
melanocarpus Nutt. Fraser's Cat. name only, Hooker Fl. Bor. Am.
 1 150 1834 is *Missouriensis*
Menziesii Gray Proc. Am. Acad. 6 217 1864 is *vestitus* var.
metanus Jones Cont. 7 666, 733 1895 No. 41
Mexicanus A. DC. Pl. Rar. Gen. 4 16 t 3 1826 No. 197
A. trichocalyx Nutt. in T. & G. Fl. N. A. 1 332 1838
Tragacantha Mexicana (A. DC.) Kuntze Rev. Gen. 2 943 1891
Geoprimum Mexicanum (A. DC.) Rydberg in Small's Fl. S. E. U.
 S. 616, 1332 1903
micranthus Nutt. Jour. Phil. Acad. 3 122 1823 is *Nuttallianus*
microcystis Gray Proc. Am. Acad. 6 220 1864 is *miser*
microlobus Gray Proc. Am. Acad. 6 203 1864 is *parviflorus* var.
Miguelensis Greene Pitt. 1 33 1887 No. 58
militaris Jones
minor [Hooker] Jones Cont. 10 64 1902 is *elegans*
misellus Watson Proc. Am. Acad. 21 449 1886 is *Howellii* var.
miser Douglas in Hooker Fl. Bor. Am. 1 153 1834 No. 32
Tragacantha misera [Douglas] Kuntze Rev. Gen. 2 949 1891
Homalobus miser [Douglas] Rydberg Torr. Bull. 40 52 1913
Phaca misera [Douglas] Piper Fl. Wash. 373 1906

- A. microcystis* Gray Proc. Am. Acad. 6 220 1864
Phaca microcystis (Gray) Rydberg Fl. Mont. 245 1900
A. debilis Walp. Rep. 1 710 1842
miserandrus Greene Erythea 3 76 1895 is *Hornii* var. *Bajaensis*. The use of such an insulting name as this, evidently intended to reflect on Sheldon, surpasses the bounds of professional courtesy and common decency.
- Missouriensis* Nutt. Gen. 2 99 1818 No. 173
Tragacantha Missouriensis (Nutt.) Kuntze Rev. 2 943 1891
Xylophacos Missouriensis (Nutt.) Rydberg in Small's Fl. S. E. U. S. 620, 1332 1903
 Var. *cuspidocarpus* (Sheldon Minn. Bot. Stud. 9 149 1894 as species) Jones
Xylophacos cuspidocarpus (Sheldon) Rydberg Torr. Bull. 40 48 1913
A. puniceus Osterhout Muhl. 1 140 1906
Shortianus var. *minor* Gray Proc. Am. Acad. 6 211 1864
thermalis Greene Erythea 3 76 1895
- Moencoppensis* Jones Zoe 2 12 1891 No. 203
Mogollonicus Greene Torr. Bull. 8 97 1881 is *Bigelovii*
Mohavensis Watson Proc. Am. Acad. 20 361 1885 No. 93
Mokiensis Gray Proc. Am. Acad. 13 367 1878 is *lentiginosus* var.
mollissimus Torr. Ann. N. Y. Lyc. 2 178 1828 No. 191
Phaca villosa James Cat. 186 1825
A. simulans Cockerell Torrey 2 154 1902
- montanus* (Nutt.) Jones No. 16 Page 80
Kentrophyta montana Nutt. in T. & G. Fl. N. A. 1 353 1838
viridis l. c.
Wolffi Rydberg Torr. Bull. 32 665 1905
A. Kentrophyta Gray Proc. Phil. Acad. Ser. 2 7 60 1863
viridis (Nutt.) Sheldon Minn. Bot. Stud. 9 118 1894
Homalobus montanus (Nutt.) Britton Fl. 2 306 1897
Wolffi Rydberg Torr. Bull. 31 562 1904
Tragacantha montana (Nutt.) Kuntze Rev. Gen. 2 941 1891
Phaca viridis (Nutt.) Britton Mem. Torr. Club 5 201 1894
 Var. *Coloradoensis* Jones
A. Kentrophyta var. *Coloradoensis* Jones Cont. 10 63 1902
 Var. *impensus* (Sheldon) Jones
A. viridis var. *impensus* Sheldon Minn. Bot. Stud. 9 118 1894
Kentrophyta var. *elatus* Watson Bot. King 77 1871
Kentrophyta impensa (Sheldon) Rydberg Torr. Bull. 32 665 1905
 Var. *rotundus* Jones
A. tegetarius var. *rotundus* Jones Cont. 7 650 1895
Kentrophyta var. *rotundus* Jones Cont. 9 42 1898
 Var. *tegetarius* (Watson) Jones
A. tegetarius Watson Bot. King 76 1871
 Var. *implexus* Canby in Porter & Coulter Fl. Col. App. 1874
aculeatus Nelson Torr. Bull. 26 10 1899
Homalobus aculeatus (Nelson) Rydberg Fl. Mont. 246 1900
tegetarius (Watson) Rydberg Torr. Bull. 31 563 1904
Kentrophyta tegetaria (Watson) Rydberg Torr. Bull. 40 52 1913
aculeata (Nelson) Rydberg Torr. Bull. 32 665 1905
Tragacantha tegetaria (Watson) Kuntze Rev. Gen. 2 941 1891
 Var. *ungulatus* Jones
A. Kentrophyta var. *ungulatus* Jones Cont. 7 650 1895
- Mortoni* Nutt. Jour. Phil. Acad. 7 19 1834 is *Canadensis* var.
Tragacantha Mortoni [Nutt.] Kuntze Rev. Gen. 2 946 1891
- Mulfordæ* Jones Cont. 8 18 1898 No. 229
Onix Mulfordæ [Jones] Rydberg Torr. Bull. 40 51 1913
multicaulis Nutt. in T. & G. Fl. N. A. 1 335 1838 is *pubentissimus*
multiflorus Gray Proc. Am. Acad. 6 226 1864 is *tenellus*
Musiniensis Jones Cont. 7 671 1895 No. 171
Xylophacos Musiniensis [Jones] Rydberg Torr. Bull. 40 49 1913
naturitensis Payson Bot. Gaz. 60 377 1915 is *desperatus*
Nebraskensis Bates Torrey 5 216 1905 is *lotiflorus* var.

- neglectus (T. & G.) Sheldon Minn. Bot. Stud. 9 59 1894 No. 129
 Phaca neglecta T. & G. Fl. N. A. 1 344 1838
 Tragacantha neglecta (T. & G.) Kuntze Rev. Gen. 2 941 1891
 A. Cooperi Gray Man. Ed. 2 98 1856
 Neomexicanus Wooton & Standley Cont. Nat. Herb. 16 136 1913
 No. 159
 Nevinii Watson Proc. Am. Acad. 21 412 1886 No. 231
 Newberryi Gray Proc. Am. Acad. 12 55 1876 No. 175
 Var. castoreus Jones Cont. 7 658 1895
 Var. eriocarpus (Watson) Jones Cont. 7 676 1895 is var. Watsonianus
 Var. Watsonianus (Kuntze) Jones Cont. 10 68 1902
 Tragacantha Watsoniana Kuntze Rev. Gen. 2 942 1891
 A. eriocarpus Watson Bot. King 71 1871
 Newberryi var. eriocarpus (Watson) Jones Cont. 7 658 1895
 suturalis Sheldon Minn. Bot. Stud. 9 23 1894
 Candelarius Sheldon Minn. Bot. Stud. 9 143 1894 and var.
 exiguus l. c.
 Xylophacos Watsonianus (Kuntze) Rydberg Torr. Bull. 40 47 1913
 Newberryi x Eurekaensis Jones
 nigrescens Nutt. Pl. Gamb. 152 1848 No. 267
 Gambellianus Sheldon Minn. Bot. Stud. 9 21 1894
 Hesperastragalus Gambellianus (Sheldon) Heller Muhl. 2 87 1905
 nigrescens (Nutt.) Heller Muhl. 2 218 1906
 nigrescens Gray Am. Jour. Sci. Ser. 2 33 410 1862 is tenellus
 nitidus Douglas in Hooker Fl. Bor. Am. 1 149 1834 No. 130
 not A. laxmanni nor adsurgens.
 Var. robustior (Hooker) Jones
 A. adsurgens Hooker Fl. Bor. Am. 1 149 1834
 sulphurescens Rydberg Torr. Bull. 28 36 1901
 striatus Nutt. in T. & G. Fl. N. A. 1 330 1838
 Chandonetii Lunell Am. Mid. Nat. 2 127 1911
 nothoxys Gray Proc. Am. Acad. 6 232 1864 No. 242
 Tragacantha nothoxys (Gray) Kuntze Rev. Gen. 2 943 1891
 Oxytropis nothoxys (Gray) Jones Cont. 7 677 1895
 Spiesia " " " " " " " " " " " "
 Aragallus " " " " " " " " " " " "
 nudisiliquus Nelson Bot. Gaz. 54 410 1912 is glareosus, old pods.
 nudus Watson Bot. King 74 1871 is Serenoi
 nutans Jones No. 53 Page 108
 Nuttallianus DC. Prod. 2 289 1825 No. 240
 A. micranthus Nutt. Proc. Phil. Acad. 3 122 1823
 Hamosa micrantha (Nutt.) Rydberg in Small's Fl. S. E. U. S.
 613, 1332 1903
 austrina Rydberg l. c.
 Nuttalliana (DC.) l. c. 617
 subuniflorus Greene Leaflets 2 42 1910
 Var. canescens T. & G. Pac. R. R. Rep. 2 163 1855 is Nuttallianus
 Var. Cedrosensis (Vasey & Rose) Jones
 A. Cedrosensis Vasey & Rose Cont. Nat. Herb. 1 15 1893
 pertenuis Greene Leaflets 2 42 1910
 Var. enneajugus Jones Cont. 8 22 1898
 Var. leptocarpoides Jones l. c.
 Var. pumilus Gray Pl. Wr. 1 52 1852 is var. trichocarpus
 Var. quadrilateralis Jones l. c.
 Var. trichocarpus T. & G. Fl. N. A. 1 334 1838
 A. trichocarpus (T. & G.) Young Fl. Tex. 228 1873
 Oaxacanus Rose in Jones Cont. 8 9 1898 is Guatamalensis
 obcordatus Ell. Sketchbook 2 227 1822 No. 82
 Tragacantha obcordata (Ell.) Kuntze Rev. Gen. 2 941 1891
 Tium obcordatum (Ell.) in Small's Fl. S. E. U. S. 616, 1332 1903
 A. Elliottii Dietr. Syn. Pl. 4 1080 1850
 obfalcatus Nelson Bot. Gaz. 54 411 1912 is malacus
 oblatus Sheldon Minn. Bot. Stud. 9 21 1894 is Serenoi
 obscurus Watson Bot. King 69 1871 No. 82
 Tragacantha obscura [Watson] Kuntze Rev. 2 943 1891
 occidentalis [Watson] Jones Cont. 8 17 1898 is Labradoricus var.
 Olympicus Cotton Torr. Bull. 35 573 1908 is Cottoni
 oocalycis Cont. 8 10 1898 No. 207
 urceolatus Greene ined. ?

- oocarpus* Gray Proc. Am. Acad. 6 213 1864 No. 60
Tragacantha oocarpa (Gray) Kuntze Rev. Gen. 2 946 1891
A. Crotalariae and *crotalarioides* Torr. Mex. Bound. 56 and t. 17 1859
oophorus Watson Bot. King 73 1871 No. 76
A. artipes Gray Proc. Am. Acad. 13 370 1878
megacarpus var. *caulescens* Jones Cont. 7 643 1895
Phaca artipes (Gray) Rydberg Torr. Bull. 32 664 1905
Orcuttianus Watson Proc. Am. Acad. 20 361 1885 No. 222
 Var. *Gregorianus* Jones Cont. 10 63 1902
Oreganus Nutt. in T. & G. Fl. N. A. 1 335 1838 No. 127
A. ventorum Gray Am. Nat. 8 212 1874
oreophilus Rydberg Torr. Bull. 31 561 1904 is *Canadensis* var.
Orizabæ Seaton Proc. Am. Acad. 28 117 1893 No. 193
oroboides var. *Americanus* Gray Proc. Am. Acad. 6 205 1864
 is *elegans*
orthanthus Gray Proc. Am. Acad. 6 195 1864 No. 195
Tragacantha orthantha (Gray) Kuntze Rev. Gen. 2 946 1891
Osterhouti Jones No. 208
Owyheensis Nelson Bot. Gaz. 55 375 1913 is *atratus* var.
oxyphysis Gray Proc. Am. Acad. 6 218 1864 No. 68
Tragacantha oxyphysa (Gray) Kuntze Rev. Gen. 2 946 1891
Phaca oxyphysa (Gray) Heller Muhl. 2 86 1906
oxyrhynchus Hemsley Bot. Cent. Am. 1 265 1880 No. 261
Tragacantha oxyrhyncha (Hems.) Kuntze Rev. Gen. 2 946 1891
pachycarpus T. & G. Fl. N. A. 1 332 1838 is *crassicarpus*
pachypus Greene Bull. Cal. Acad. 3 157 1885 No. 112
Pacificus Sheldon Minn. Bot. Stud. 9 174 1894 is *accidens* var.
Painteri Rose No. 148
palaus Jones Cont. 4 37 1893 is *lentiginosus* var.
Palliseri Gray Proc. Am. Acad. 6 227 1864 is *campestris* var.
Tragacantha Palliseri (Gray) Kuntze Rev. 2 946 1891
Palmeri Gray Proc. Am. Acad. 7 398 1868 No. 44
Tragacantha Palmeri (Gray) Kuntze Rev. Gen. 2 946 1891
Palousensis Piper Bot. Gaz. 22 489 1896 is *arrectus*
Panamintensis Sheldon in Coville's Death Val. Rep. 87 1893 No. 140
Panguicensis Jones Cont. 10 62 1902 is *argophyllus* var.
Parishii Gray Proc. Am. Acad. 19 75 1883 is *Douglasii* var.
Parryi Gray Am. Jour. Sci. Ser. 2 33 410 1862 No. 182
Tragacantha Parryi (Gray) Kuntze Rev. Gen. 2 947 1891
Xylophacos Parryi (Gray) Rydberg Torr. Bull. 32 662 1905
parviflorus (Pursh) MacMillan Metasperm. 325 1892 No. 152
Dalea parviflora Pursh Fl. 474 1814
Tragacantha parviflora (Pursh) Kuntze Rev. Gen. 2 947 1891
Microphacos parviflorus [Pursh] Rydberg Torr. Bull. 40 51 1913
Psoralea parviflora (Pursh) Poir. Encyc. Supp. 4 590 1823
A. gracilis Nutt. Gen. 2 100 1818
Phaca gracilis (Nutt.) MacMillan Metasperm. 325 1892
 Var. *microlobus* (Gray) Jones
A. microlobus Gray Proc. Am. Acad. 6 203 1864
Tragacantha microloba (Gray) Kuntze Rev. Gen. 2 947 1891
Microphacos microlobus (Gray) Rydberg Torr. Bull. 32 663 1905
parvus Hemsley Bot. Cent. Am. 2 266 1880 No. 250
Tragacantha parva [Hemsley] Kuntze Rev. Gen. 2 947 1891
Pasqualensis Jones Cont. 10 87 1902 No. 13A Page 78
Pattersoni Gray in Brandegee's Rep. S. W. Col. 285 1876 No. 117
A. diphysus var. *albiflorus* Gray Pl. Fend. 34 1849
recedens Greene ined ?
Tragacantha Pattersoni [Gray] Kuntze Rev. Gen. 2 947 1891
Phacopsis Pattersoni [Gray] Rydberg Torr. Bull. 32 661 1905
Rydbergiella Pattersoni [Gray] Fedde & Sydow, Just. Bot. Jahr.
 33 part 1 534 1906
 Var. *prælongus* [Sheldon] Jones Cont. 10 65 1902
A. prælongus Sheldon Minn. Bot. Stud. 9 23 1894
Rothrockii Sheldon Minn. Bot. Stud. 9 174 1894
procerus Gray Proc. Am. Acad. 13 369 1878
Pattersoni var. *procerus* [Gray] Jones Cont. 7 636 1895
Phacopsis prælongus [Sheldon] Torr. Bull. 32 661 1905
Rydbergiella prælonga [Sheldon] Fedde & Sydow, Just. Jahr.
 part 1 33 534 1906

- pauciflorus* Hooker Fl. Bor. Am. 1 149 1834 No. 31 Page 97
Tragacantha pauciflora (Hooker) Kuntze Rev. Gen. 2 947 1891
A. vexiliflexus Sheldon Minn. Bot. Stud. 9 19 1894
Homalobus vexiliflexus (Sheldon) Rydberg Fl. Mont. 249 1900
pauciflorus Gray Proc. Phil. Acad. Ser. 2 7 50 1863 is *leptaleus*
pauperculus Greene Pitt. 3 224 1897 is *Rattani*
Peabodianus Jones Cont. 3 295 1893 is *pubentissimus*
pectinatus Douglas in Hooker Fl. Bor. Am. 1 142 1830 No. 104
Phaca pectinata (Douglas) Hooker Fl. Bor. Am. 1. c. 141
Tragacantha pectinata (Douglas) Kuntze Rev. Gen. 2 947 1891
Ctenophyllum pectinatum (Douglas) Rydberg Torr. Bull. 32 663 '05
 Var. *platyphyllus* Jones Cont. 10 87 1902
pephragmenus Jones Cont. 5 267 1893 is *argophyllus* var.
pertenuis Greene Leaflets 2 42 1910 is *Nuttallianus* var.
Phœnicis Jones Cont. 8 12 1898 No. 189
 A. *intermedius* Jones Cont. 7 656 1895
pictus Boiss. & Gal. Diagn. Pl. Or. 36 55 1859 is *nomen nudum*
pictus Gray Proc. Am. Acad. 6 214 1864 No. 54, Page 109
Dalea picta Gray Pl. Fend 37 1849
Tragacantha picta (Gray) Kuntze Rev. Gen. 2 947 1891
 A. *angustus* Jones Cont. 7 635 1895
 Var. *ceramicus* (Sheldon) Jones Cont. 10 62 1902
ceramicus Sheldon Minn. Bot. Stud. 9 19 1894
pictus var. *angustus* Jones Cont. 4 37 1893
ceramicus var. *Jonesii* Sheldon Minn. Bot. Stud. 9 19 1894
 Var. *foliolosus* (Gray) Sheldon Minn. Bot. Stud. 9 138 '94
pictus var. *foliolosus* Gray Proc. Am. Acad. 6 215 1864
 Var. *filifolius* Gray Proc. Am. Acad. 6 215 1864
 A. *filifolius* Gray Pac. R. R. Rep. 12 42 t. 1A 1860
ceramicus var. *imperfectus* Sheldon Minn. Bot. Stud. 9 19
angustus var. *imperfectus* (Sheldon) Jones Cont 10 62 1902
 Var. *longifolius* (Pursh) Jones Cont. 7 635 1895
Psoralea longifolia Pursh Fl. 741 1814
Orobus longifolius (Pursh) Nutt. Gen. 2 95 1818
Physandra longifolia (Pursh) Raf. Atl. Journ. 145 1832
 Var. *magnus* Jones
pinonis Jones Cont. 8 14 1898 No. 158
piscinus Jones Cont. 7 645 1895 is *Douglasii* var.
Plattensis Nutt. in T. & G. Fl. N. A. 1 332 1838 No. 198
Phaca Plattensis (Nutt.) MacMillan Metasperm. 325 1892
Geoprimum Plattense (Nutt.) Rydberg in Small's Fl. S. E. U. S.
 615. 1332 1903
 Var. *Tennesseeensis* Gray Proc. Am. Acad. 6 193 1864
platytropis Gray Proc. Am. Acad. 6 526 1865
Tragacantha platytropis (Gray) Kuntze Rev. Gen. 2 947 1891
Phaca platytropis (Gray) Rydberg Fl. Mont. 246 1900
Cystium platytropis (Gray) Rydberg Torr. Bull. 40 50 1913
playanus Jones Cont. 8 6 1898 is *triflorus* var.
polaris [Seeman] Benth. in Hook. f. Pl. Arct. 323 1861 No. 26, P. 88
Oxytropis polaris Seeman Voy. Herald Narr. 2 24 1852
Tragacantha polaris [Seeman] Kuntze Rev. Gen. 2 947 1891
Pomonensis Jones Cont. 10 59 1902 No. 56, Page 110
Pondii Greene Pitt. 1 288 1889 is *insularis* var.
porrectus Watson Bot. King 75 1871 No. 6, Page 62
Tragacantha porrecta (Watson) Kuntze Rev. Gen. 2 947 1891
prælongus Sheldon Minn. Bot. Stud. 9 23 1894 is *Pattersoni* var.
Preussii Gray Proc. Am. Acad. 6 222 1864 No. 113
Tragacantha Preussii [Gray] Kuntze Rev. Gen. 2 947 1891
Phaca Preussii [Gray] Rydberg Torr. Bull. 40 47 1913
 Var. *arctus* Sheldon Minn. Bot. Stud. 9 130 1894 is typical
 Var. *Eastwoodæ* Jones
 A. *Eastwoodæ* Jones Cont. 6 368 1894
Phaca Eastwoodæ [Jones] Rydberg Torr. 32 664 1905
 A. *Preussii* var. *sulcatus* Jones 4 37 1893
 Var. *latus* Jones Cont. 4 36 1893 is nearly typical
 Var. *laxiflorus* Gray Proc. Am. Acad. 13 369 1878
 Var. *laxispicatus* Sheldon Minn. Bot. Stud. 9 130 1894 is var.
laxiflorus

- Preussii* var. *sulcatus* Jones Cont. 4 37 (1893).
Eastwoodæ Jones Cont. 6 368 (1894).
Pringlei Watson Proc. Am. Acad. 21 449 (1886). No. 249 p. 276.
procerus Gray Proc. Am. Acad. 13 369 (1878) is *A. Pattersoni* var.
prælongus (Sheldon) Jones.
procumbens Watson Proc. Am. Acad. 20 361 (1885) is *A. accum-*
bens Sheldon.
proriferus Jones Cont. 5 275 (1893) No. 40, p. 101.
prunifer Rydberg Fl. Mont. 239 (1900) is *A. crassicarpus* Nutt.
pruniformis Jones Cont. 7 660 (1895) is *A. accidens* var. *Hender-*
soni (Watson) Jones.
pteroecarpus Watson Bot. King 71 (1871) No. 102, p. 147.
pubentissimus T. & G. Fl. 1 693 (1840) No. 35, p. 99.
multicaulis Nutt. in T. & G. Fl. 1 335 (1838).
Peabodianus Jones Cont. 3 295 (1893).
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Pueblæ Jones Cont. 14 35 (1912) No. 248, p. 275.
Pulsiferæ Gray Proc. Am. Acad. 10 69 (1874) No. 33, p. 98.
Suksdorfii Howell *Erythea* 1 111 (1893).
Tragacantha—Kuntze Rev. Gen. 2 947 (1891).
punicæus Osterhout Muhl. 1 140 (1906) is *A. Missouriensis*.
Xylophacos—Rydberg Torr. Bull. 32 662 (1905).
Purpasi Jones Cont. 14 34 (1912) No. 265, p. 281.
Purshii Dougl. in Hook. Fl. Bor. Am. 1 152 (1834) No. 181, p. 222.
Phaca mollissima Nutt. in T. & G. Fl. 1 350 (1838).
Tragacantha—Kuntze Rev. Gen. 2 917 (1891).
Xylophacus Rydberg Torr. Bull. 32 662 (1905). Also Heller Muhl.
2 217 (1906).
Var. *coccineus* Parry West Am. Sci. 7 10 (1890). Nomen nudum,
is *A. coccineus* (Parry) Brandegee.
Var. *interior* Jones p. 222.
Var. *longilobus* Jones Cont. 5 269 (1893) p. 223.
Var. *leucolobus* Jones Cont. 5 270 (1893) and Cont. 10 61 (1902)
p. 223.
Var. *lectulus* (Watson) Jones Cont. 10 61 (1902) p. 223.
A. lectulus Watson Proc. Am. Acad. 22 471 (1887).
Var. *tinctus* Jones Cont. 5 269 (1893) p. 223.
Purshii x *glareosus* Jones p. 221.
Purshii x *Newberryi* Jones p. 216.
Purshii x *Watsonianus* Jones p. 216.
pychnostachyus Gray Proc. Am. Acad. 6 257 (1864) No. 45, p. 103.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
pygmaeus (Nutt.) Jones No. 170, p. 210.
Phaca pygmaea Nutt. in T. & G. Fl. 1 349 (1838).
Tragacantha—Kuntze Rev. Gen. 2 941 (1891).
Xylophacos Rydberg Torr. Bull. 32 662 (1905).
A. Chamaeleuce Gray Bot. Ives 10 (1860).
Var. *lanceoliticus* Jones Cont. 7 672 (1895) as *Chamaeleuce* var.
p. 211.
quinqueflorus Watson Proc. Am. Acad. 21 450 (1886) No. 23, p. 81.
racemosus Pursh Fl. 740 (1814) No. 208, p. 247.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Tium—Rydberg Torr. Bull. 32 659 (1905).
Var. *brevisetus* Jones Cont. 7 662 (1895) p. 247.
Var. *longisetus* Jones Cont. 7 663 (1895) p. 247.
rasus Sheldon Minn. Bot. Stud. 9 158 (1894) is *A. scopulorum* P. & C.
Rattani Gray Proc. Am. Acad. 19 75 (1883) No. 238, p. 269.
pauperculus Greene Pitt. 3 224 (1897).
recedens Greene Unpub. (?) is *A. Pattersoni* Gray.
reticarpus Wood Bot. Gaz. 3 50 (1878) is *A. Lindheimeri* Gray.
recurvus Greene Bull. Cal. Acad. 3 155 (1885) No. 141, p. 186.
reflexus T. & G. Fl. N. A. 1 334 (1838) No. 266, p. 284.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
remulus Jones Cont. 7 658 (1895) No. 169, p. 209.
Var. *Chloridæ* Jones p. 210.

- reptans Willd. Hort. Berol. 2 88 (1816) No. 204, p. 191.
 Tragacantha—Kuntze Rev. Gen. 2 (1891).
- reventoides Jones Cont. 7 661 (1895) is *A. terminalis* var.
 Cnemidophacos—Rydberg Torr. Bull. 40 52 (1913).
- reventus Gray Proc. Am. Acad. 15 46 (1879) No. 115, p. 160.
 Cnemidophacos—Rydberg Torr. Bull. 40 52 (1913).
 var. *Canbyi* Jones Cont. 8 11 (1898).
- Var. *conjunctus* (Watson) Jones Cont. 10 61 (1902) p. 160.
A. conjunctus Watson Proc. Am. Acad. 18 371 (1882).
conjunctus var. *Hoodianus* (Howell) Jones Cont. 8 9 (1898).
 [*A. Hoodianus* Howell *Erythea* 1 111 (1893).
A. conjunctus var. *oxytropidoides* Jones Cont. 7 665 (1895).
- Richardsoni* Sheldon Minn. Bot. Stud. 9 126 (1894) is *A. aboriginum*.
A. vaginatus Rich. in Hook. Fl. Bor. Am. 1 149 (1834).
- Robbinsii* (Oakes) Gray Man. Ed. 2 98 (1856) is *A. Labradoricus* var.
 Var. *Josupi* Eggleston & Sheldon in Minn. Bot. Stud. 9 155
 (1894) is *A. Labradoricus* DC.
 Var. *borealis* Eggleston Bot. Gaz. 20 271 (1895) is *A. Labradoricus* DC.
 Var. *occidentalis* Watson Bot. King 70 (1871) is *A. Labradoricus* var.
- Rosei* Jones No. 150, p. 190.
- Roethrockii* Sheldon Minn. Bot. Stud. 9 174 (1894) is *A. Pattersoni* var.
- Rusbyi* Greene Bull. Cal. Acad. 1 8 (1884) is *A. strigulosus* var.
brevidentatus Hemsley.
 Var. *longissimus* Jones Cont. 7 662 (1895) is *A. strigulosus* H.B.K.
- sabulonum* Gray Proc. Am. Acad. 13 368 (1878) No. 36, p. 99.
Phaca sabulonum (Gray) Rydberg Torr. Bull. 40 47 (1913).
- sabulosus* Jones Cont. 2 239 (1891) No. 114, p. 156.
- salinus* Howell *Erythea* 1 111 (1893) is *A. lentiginosus* Dougl.
- Salmonis* Jones Cont. 8 9 (1898) No. 136, p. 180.
- Saltonis* Jones No. 258, p. 279.
- scalaris* Watson Proc. Am. Acad. 23 270 (1888) No. 50, p. 106.
 Var. *quercetinus* Jones p. 107.
- scaphoides* Jones Cont. 10 69 (1902) is *A. arrectus* var.
- scaposus* Gray Proc. Am. Acad. 13 366 (1878) is *A. calycosus* var.
- Schaffneri* Jones No. 257, p. 276.
- sclerocarpus* Gray Proc. Am. Acad. 6 225 (1864) No. 104, p. 149.
 Tragacantha—Kuntze Rev. Gen. 2 (1891).
Phaca podocarpa Hook. Fl. Bor. Am. 1 142 (1840).
- scobinatulus* Sheldon Minn. Bot. Stud. 9 24 (1894) is *A. Haydenianus* Gray.
- scopulorum* Porter Fl. Col. 24 (1874) No. 209, p. 247.
subcompressus Gray in Brandegee Rep. 234 (1876).
rasus Sheldon Minn. Bot. Stud. 9 158 (1894).
Tium—Rydberg Torr. Bull. 32 659 (1905).
 Tragacantha—Kuntze Rev. Gen. 2 (1891).
- Seatoni* Jones Cont. 7 676 (1895) No. 262, p. 280.
 Var. *Crucis* Jones p. 281.
- secundus* Mx. Fl. 2 66 (1803) is *A. Labradoricus* DC.
- selenius* Greene *Erythea* 3 76 (1895) is *A. amphioxys* Gray.
- Serenoi* (Kuntze) Sheldon Minn. Bot. Stud. 9 130 (1894) No. 106,
 p. 150.
 Tragacantha—Kuntze Rev. Gen. 2 941 (1891).
nudus Watson Bot. King 74 (1871).
oblatus Sheldon Minn. Bot. Stud. 9 19 (1894).
- sericoleucus* Gray Am. Jour. Sci. Series 2 33 410 (1862) No. 21, p. 83.
Phaca sericea Nutt. in T. & G. Fl. 1 343 (1838).
Orophaca sericea (Nutt.) Britton & Brown Fl. 2 307 (1897).
 Tragacantha—Kuntze Rev. Gen. 2 942 (1891).
Phaca trifoliata Nutt. MS.
 Var. *aretioides* Jones Cont. 8 13 (1898) p. 84.
Orophaca—Rydberg Torr. Bull. 32 668 (1905).

- Var. *tridactylicus* (Gray) Jones Cont. 10 69 (1902) p. 84.
A. tridactylicus Gray Proc. Am. Acad. 6 527 (1865).
Orophaca—Rydberg Torr. Bull. 32 668 (1905).
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Phaca digitata Torr. Frem. Rep. 89 (1845).
serotinus Gray Pac. R. R. Rep. 12 18 51 t. 5 (1860) is *A. campestris* var.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
sesquiflorus Watson Proc. Am. Acad. 10 346 (1875) No 18, p. 82.
Phaca—Rydberg Torr. Bull. 40 48 (1913).
serpens Jones Cont. 7 641, 644 (1895) No. 52, p. 108.
Phaca—Rydberg Torr. Bull. 40 47 (1913).
Chearis Rydberg Torr. Bull. 31 562 (1904) is *A. elegans* (Hook.) Sheldon.
Atelophragma—Rydberg Torr. Bull. 32 660 (1905).
Shockleyi Jones Cont. 7 659 (1895) is *A. Serenoi* (Kuntze) Sheldon.
Shortianus Nutt. in T. & G. Fl. 1 331 (1838) No. 166, p. 205.
Tragacantha—Kuntze Rev. Gen. 2 944 (1891).
Xylophacos—Rydberg in Small Fl. S. E. U. S. 1332 (1903).
iodopetalus Greene in Herb.
humilis Geyer Lond. Jour. Bot. 6 211 (1847).
 Var. *cyaneus* (Gray) Jones Cont. 8 5 (1898) and 10 65 (1902) p. 206.
A. cyaneus Gray Pl. Fend. 34 (1849).
Shortianus var. *minor* Gray Proc. Am. Acad. 6 211 (1864) in part.
 Var. *minor* Gray Proc. Am. Acad. 6 211 (1864) in part is *A. Missouriensis* Nutt.
Sileranus Jones Zoe 2 242 (1891) No. 160 p. 196.
Phaca—Rydberg Torr. Bull. 40 47 (1913).
 Var. *cariacus* Jones Cont. 7 642 (1895) p. 197.
simplicifolius (Nutt.) Gray Proc. Am. Acad. 6 231 (1864) No. 14, p. 78.
Phaca—Nutt. in T. & G. Fl. 1 350 (1838).
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Homalobus—Rydberg Torr. Bull. 40 52 (1913).
uniflorus Rydberg Torr. Bull. 34 49 (1907).
brachycarpus Nutt. in T. & G. Fl. 1 352 (1838).
canescens Nutt. l. c.
 Var. *caespitosus* (Nutt.) Jones Cont. 7 647 (1895) p. 79.
Homalobus caespitosus Nutt. in T. & G. Fl. 1 352 (1838).
 Var. *spatulatus* (Sheldon) Jones Cont. 7 65 (1912).
A. spatulatus Sheldon Minn. Bot. Stud. 9 22 (1894).
caespitosus (Nutt.) Gray Proc. Am. Acad. 6 230 (1864).
Tragacantha caespitosa Kuntze Rev. Gen. 2 943 (1891).
Homalobus canescens Nutt. in T. & G. Fl. 1 352 (1838).
A. lingulatus Sheldon Minn. Bot. Stud. 9 118 (1894).
 Var. *spatulatus* (Sheldon) Jones Cont. 10 65 (1902). See above.
 Is var. *caespitosus*.
A. spatulatus Sheldon Minn. Bot. Stud. 9 22 (1894).
simplicifolius var. *spatulatus* (Sheldon) Jones Cont. 7 647 (1895).
Homalobus lingulatus (Sheldon) Rydberg Torr. Bull. 40 52 (1913).
simulans Cockerell Torreyia 2 154 (1902) is *A. mollissimus* Tor.
sinuatus Piper Torr. Bull. 28 40 (1901) is *A. Gibbsii* Kell.
Sonorae Gray Pl. Wr. 2 44 (1853) is *A. humistratus* var.
Sonneanus Greene Pitt. 3 186 (1897) is *A. Hookerianus* T. & G.
sophoroides Jones Zoe 2 12 (1891) No 200, p. 240.
Spaldingii Gray Proc. Am. Acad. 6 524 (1865).
A. Chaetodon Torr. l. c.
Phaca Spaldingii (Gray) Piper Fl. Wash. 370 (1906).

- Tragacantha*—Kuntze Rev. Gen. 2 (1891).
sparsiflorus Gray Proc. Phil. Acad. Ser. 2 7 60 (1863), Pl. Hall & Harbour No. 128, name only. Proc. Am. Acad. 6 205 (1864).
- Tragacantha*—Kuntze Rev. Gen. 2 (1891).
Tium—Rydberg Torr. Bull. 32 660 (1905).
variegatum Rydberg Torr. Bull. 34 48 (1907).
 Var. *majusculus* Gray Proc. Am. Acad. 6 206 (1864) p. 130.
 Var. *major* Gray Proc. Phil. Acad. Ser. 2 7 60 (1863), name only.
- spatulatus* Sheldon Minn. Bot. Stud. 9 22 (1894) is *A. simplicifolius* var.
- speirocarpus* Gray Proc. Am. Acad. 6 225 (1864) No. 95, p. 141.
Phaca speirocarpa (Gray) Piper Fl. Wash. 370 (1906).
A. Whitedi Piper Torr. Bull. 20 (1902).
 Var. *falciformis* Gray Bot. Cal. 1 152 (1876) is *A. Gibbsii* var. *curvicarpus*.
 Var. *curvicarpus* Sheldon Minn. Bot. Stud. 9 126 (1894) is *A. Gibbsii*. var. *curvicarpus* (Sheldon) Jones.
- spicatus* Nutt. in T. & G. Fl. 1 336 (1838) is *A. Canadensis* var. *Mortoni*.
- stenophyllus* T. & G. Fl. 1 329 (1838) No. 4 p. 71.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Phaca—Piper Fl. Wash. 371 (1906).
Homalobus—Rydberg Fl. Mont. 249 (1900).
filipes (Torr.) Heller Muhl. 9 67 (1913).
A. leptophyllus Nutt. Jour. Phil. Acad. 7 18 (1834).
filipes Torr. Bot. Wilkes 278 (1854).
- stipularis* Jones Cont. 7 655 (1895) is *A. desperatus* Jones.
straturensis Jones Cont. 8 19 (1898) No. 142 p. 186.
Hamosa atratiformis Rydberg Torr. Bull. 34 48 (1907).
- streptopus* Greene Bull. Cal. Acad. 3 155 (1885) is *A. acutirostris* Watson.
- striatiflorus* Jones Cont. 7 643 (1895) is *A. Sileranus* Jones.
striatus Nutt. in T. & G. Fl. 1 330 (1838) is *A. nitidus* var. *robustior*.
strigosus (Kell.) Sheldon Minn. Bot. Stud. 9 24 (1894) is *A. tener* Gray.
- strigosus* Coulter & Fisher Bot. Gaz. 18 299 (1893) is *A. campestris* var.
- strigulosus* H. B. K. Nov. Gen. & Sp. 6 494 (1824) No. 143, p. 186.
Tragacantha—Kuntze Rev. Gen. 2 948 (1891).
A. Rusbyi var. *longissimus* Jones Cont. 7 662 (1895).
 Var. *gracilis* Hemsley Bot. Cent. Am. 1 266 (1880) p. 187.
 Var. *brevidentatus* Hemsley Bot. Cent. Am. 1 266 (1880) p. 187.
A. Rusbyi Greene Bull. Cal. Acad. 1 8 (1884).
altus Wooton & Standley Cont. Nat. Herb 16 36 (1913).
- subcinereus* Gray Proc. Am. Acad. 13 366 (1878) No. 49, p. 106.
Phaca subcinerea (Gray) Rydberg Torr. Bull. 40 47 (1913).
A. Wootoni Sheldon Minn. Bot. Stud. 9 138 (1894).
- subcompressus* Gray in Brandegee Rep. Col. 234 (1876) is *A. scopulorum*.
- subuniflorus* Greene Leaflets 2 42 (1910) is *A. Nuttallianus* DC.
succulentus Rich. in Frankl. Jour. Supp. 18 (1823) is *A. crassicarpus*.
Geoprannon succulentum (Rich.) Rydberg Torr. Bull. 32 658 (1905).
- succumbens* Dougl. in Hook. Fl. Bor. Am. 1 151 (1834) No. 187, p. 228.
A. doryenioides Dougl. in G. Don Gard Diet. 2 258 (1834).
- sulphureus* Rydberg Torr. Bull. 26 36 (1901) is *A. nitidus* var.
Suksdorfii Howell Erythra 1 111 (1893) is *A. Pulsiferæ* Gray.
supercanescens Greene Erythra 1 221 (1893) is *A. Bolanderi* Gray.
suturalis Sheldon Minn. Bot. Stud. 9 23 (1894) is *A. Newberryi* var.

- sylvaticus Watson Proc. Am. Acad. 23 262 (1888) No 226, p. 261.
A. umbraticus Sheldon Minn. Bot. Stud. 9 23 (1894).
 syrticolus Sheldon Minn. Bot. Stud. 9 22 (1894) is *A. Bigelovii* var.
 Tarletonis Rydberg Bull. N. Y. Gard. 2 175 (1901) is *A. agrestis*
 Dougl.
 tegetarioides Jones Cont. 10 66 (1902) No. 22, p. 84.
 tegetarius Watson Bot. King 76 (1871) is *A. montanus* var.
 var. *implexus* Canby in Porter & Coulter Fl. Col. App. (1874) is
A. montanus var.
 var. *rotundus* Jones Cont. 650 (1895) is *A. montanus* var. *ro-*
tundus.
 Tejonensis Jones Cont. 7 644 (1895) is *A. Douglasii* var. *Tejonensis*
 Jones.
 tenellus Pursh Fl. 473 (1814) No. 2, p. 69.
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Homalobus—Britton Br. & Br. Fl. 2 305 (1897).
multiflorus (Pursh) T. & G. Fl. 1 351 (1838).
dispar Nutt. in T. & G. Fl. 1 350 (1838).
Ervum multiflorum Pursh Fl. 739 (1814).
Orobis dispar Nutt. Gen. 2 95 (1818).
Physondra dispar (Nutt.) Raf. Atl. Jour. 145 (1832).
Phaca nigrescens Hook. Fl. Bor. Am. 1 143 (1830).
A. multiflorus (Pursh) Gray Proc. Am. Acad. 6 226 (1864).
nigrescens (Hook.) Gray Am. Jour. Sci. Ser. 2 33 410 (1862).
 tener Gray Proc. Am. Acad. 6 206 (1864) No. 237, p. 268.
A. Hypopiottis var. *strigosus* Kell. Proc. Cal. Acad. 2 115 (1863).
strigosus (Kell.) Sheldon Minn. Bot. Stud. 9 24 (1894).
 Titi Eastwood Torr. Bull. 32 195 (1905).
 Var. *Brucae* Jones p. 268.
 Var. *rattanoides* Jones p. 268.
 Tennesseeensis Gray in Chapman Fl. 98 (1860) No. 199, p. 238.
Plattensis var. *Tennesseeensis* Gray Proc. Am. Acad. 6 193 (1864).
Tragacantha—Kuntze Rev. Gen. 2 (1891).
Geoprimum Tennesseeense (Gray) Rydberg in Small Fl. S. E.
 States 616 1332 (1903).
 tephrodes Gray Pl. Wr. 2 45 (1853) No. 165, p. 205.
 tepicus Sheldon Minn. Bot. Stud. 9 172 (1894) is *A. ervoides* H. & A.
 terminalis Watson Proc. Am. Acad. 17 370 (1882) No. 122, p. 167.
 Var. *reventoides* Jones p. 167.
A. reventoides Jones Cont. 7 661 (1895).
Cnemidophacos reventoides (Jones) Rydberg Torr. Bull. 40 52
 (1913).
 tetrapterus Gray Proc. Am. Acad. 13 369 (1878) No. 103, p. 148.
 Var. *Capricornus* Jones p. 149.
 Texanus Sheldon Minn. Bot. Stud. 9 65, 141, 175 (1894) is *A. gi-*
ganteus.
 thermalis Greene Erythea 3 76 (1895) is *A. Missouriensis* Nutt.
 Thompsonae Watson Proc. Am. Acad. 10 345 (1875) is *A. Bigelovii*
 var.
 Thurberi Gr. Pl. Thurber 312 (1855). No. 43, p. 102.
Tragacantha—Kuntze Rev. Gen. 2 948 (1891).
 Titi Eastwood Torr. Bull. 32 195 (1905) is *A. tener* Gray.
 Toanus Jones Cont. 3 296 (1893) No. 97 p. 145.
 Tolucanus Rob. & Seaton Proc. Am. Acad. 28 104 (1893) No. 143,
 p. 190.
 Traskiae Eastwood Proc. Cal. Acad. 3 102 fig. (1899) No. 232, p. 264.
 tricarinatus Gray Proc. Am. Acad. 12 56 (1876) No. 221, p. 258.
 trichocalyx Nutt. in T. & G. Fl. 1 322 (1838) is *A. Mexicanus* A. DC.
 trichocarpus (T. & G.) Young in Fl. Tex. 228 (1873) is *A. Nuttali-*
anus.
Tragacantha trichocarpa (T. & G.) Kuntze Rev. Gen. 2 (1891).

- trichopodus (Nutt.) Gray Proc. Am. Acad. 6 218 (1864) No. 69, p. 116.
- Phaca trichopoda Nutt. in T. & G. Fl. 1 343 (1838).
- tridactylicus Gray Proc. Am. Acad. 6 527 (1865) is *A. sericoleucus* var.
- triflorus (DC.) Gray P. Wr. 2 45 (1853) No. 48, p. 104.
- Phaca triflora DC. Ast. 50 t. 1 (1802).
- DeCandolleana H. B. K. Nov. Gen. & Sp. 6 495 t. 586 (1824).
- cerussata (Sheldon) Rydberg Torr. Bull. 32 665 (1905).
- A. DeCandolleanus* (H. B. K.) Sheldon Minn. Bot. Stud. 9 140 (1894).
- cerussatus Sheldon Minn. Bot. Stud. 9 139 (1894).
- Var. Candolleanus (H. B. K.) Jones Cont. 7 637 (1895) is typical.
- Var. insularis (Kell.) Jones Cont. 7 637 (1895) is *A. insularis* Kell.
- Var. playanus Jones p. 106.
- A. playanus* Jones Cont. 8 6 (1898).
- triphyllus Pursh Fl. 740 (1814) No. 24, p. 86.
- Tragacantha—Kuntze Rev. Gen. 2 (1891).
- Phaca triphylla (Pursh) Eaton & Wr. N. A. Bot. Ed. 8 351 (1840).
- caespitosa Nutt. Gen. 2 98 (1818).
- argophylla Nutt. in T. & G. Fl. 1 342 (1838).
- Orophaca caespitosa (Nutt.) Br. & Br. Fl. 2 306 (1897).
- A. gilviflorus* Sheldon Minn. Bot. Stud. 9 21 (1894).
- triquetrus Gray Proc. Am. Acad. 13 367 (1878) No. 78, p. 122.
- A. Geyeri* var. triquetrus (Gr.) Jones Cont. 8 7 (1898).
- tristis Nutt. in T. & G. Fl. 1 336 (1838) is *A. Canadensis* var. *Mortoni*.
- troglodytus Watson Proc. Am. Acad. 20 362 (1885) No. 204, p. 242.
- Tweedyi Canby Bot. Gaz. 15 150 (1890) No. 92, p. 140.
- Uintensis Jones Cont. 7 670 (1895) is *A. argophyllus* Nutt.
- umbraticus Sheldon Minn. Bot. Stud. 9 23 (1894) is *A. sylvaticus* Watson.
- urceolatus Greene MS. is *A. oocalycis* Jones.
- ursinus Gray Proc. Am. Acad. 13 367 (1898) is *A. lentiginosus* var. *Mokiensis* (Gray) Jones.
- Utahensis (Torr.) T. & G. Pac. R. R. Rep. 2 120 (1855) No. 179, p. 228.
- Tragacantha—Kuntze Rev. Gen. 2 (1891).
- Phaca mollissima var. Utahensis Torr. Stansb. Rep. 385 t. 2 (1853).
- Zylophacos Utahensis (Torr.) Rydberg Torr. Bull. 40 49 (1913).
- vaccarum Gray Pl. Wr. 2 43 (1853) No. 259, p. 279.
- Tragacantha—Kuntze Rev. Gen. 2 (1891).
- A. Daleæ* Greene Pitt. 1 153 (1887).
- vaginatus Rich. in Hook. Fl. Bor. Am. 1 149 (1834) is *A. Richardsoni*.
- Tragacantha—Kuntze Rev. Gen. 2 (1891).
- vallaris Jones Cont. 10 59 (1902) No. 119, p. 163.
- Vaseyi Watson Proc. Am. Acad. 17 370 (1882) No. 42, p. 102.
- ventorum Gray Am. Nat. 8 212 (1874) is *A. Oregonus* Nutt.
- Tragacantha ventorum (Gray) Kuntze Rev. Gen. 2 (1891).
- vespertinus Sheldon Minn. Bot. Stud. 9 150 (1894) is *A. amphioxys* var.
- vestitus (Benth.) Watson Bib. Index 202 (1878) No. 55, p. 110.
- Phaca vestita Benth. Bot. Sulph. 13 (1844).
- Tragacantha—Kuntze Rev. Gen. 2 (1891).
- A. anemophilus* Greene Bull. Cal. Acad. 4 186 (1885).
- Var. Franciscanus (Sheldon) Jones p. 110.
- A. Franciscanus* Sheldon Minn. Bot. Stud. 9 133 (1894).
- Var. longulus l. c., Same.
- A. Crotalariae* var. *virgatus* Gray Bot. Cal. 1 149 (1876).

- Phaca Franciscana* (Sheldon) Heller Muhl. 2 217 (1906).
 Var. *Menziesii* (Gray) Jones p. 110.
A. Menziesii Gray Proc. Am. Acad. 6 217 (1864).
densifolius (Sm.) Torr. Pac. R. R. Rep. 7 10 (1856).
Phaca densifolia Smith in Rees Cycl. 27 No. 9 (1817).
Nuttallii T. & G. Fl. 1 343 (1838).
inflata Nutt. in T. & G. Fl. 1 343 (1838).
Tragacantha Nuttallii (T. & G.) Kuntze Rev. Gen. 2 (1891).
vexilliflexus Sheldon Minn. Bot. Stud. 9 21 (1894) is *A. pauciflorus*.
villosus Mx. Fl. 2 67 (1803) No. 81, p. 129.
Phaca villosa Nutt. Gen. 2 97 (1818).
Tragacantha villosa (Mx.) Kuntze Rev. Gen. 2 949 (1891).
A. intonsus Sheldon Minn. Bot. Stud. 9 23 (1894).
Tium intonsum (Sheldon) Rydberg in Small Fl. 619 1332 (1903).
Virgineus Sheldon in Coville Death Val. Rep. 88 (1893) is *A. sabulonum* Gr.
virgultulus Sheldon Minn. Bot. Stud. 9 165 (1894) is *A. agrestis* var.
viridis (Nutt.) Sheldon Minn. Bot. Stud. 9 118 (1894) is *A. montanus*.
 Var. *impensus* Sheldon Minn. Bot. Stud. 9 118 (1894) is *A. montanus* var.
Wardi Gray Proc. Am. Acad. 12 55 (1876) No. 51 p. 107.
Phaca Wardi (Gray) Rydberg Torr. Bull. 40 47 (1913).
Watsoni Sheldon Minn. Bot. Stud. 9 23 (1894) is *A. accidens* var.
Watsonianus (Kuntze) Sheldon Minn. Bot. Stud. 9 143 (1894) is *A. Newberryi* var.
Webberi Gray Bot. Cal. 1 154 (1876) No. 161, p. 202.
Tragacantha Webberi (Gray) Kuntze Rev. Gen. 2 (1891).
Wetherilli Jones Cont. 4 34 (1893) No. 64, p. 114.
Phaca Wetherilli (Jones) Rydberg Torr. Bull. 32 665 (1905).
Whitedi Piper Torr. Bull. 29 224 (1902) is *A. speirocarpus* Gray.
Whitneyi Gray Proc. Am. Acad. 6 526 (1865) is *A. Hookerianus* var.
 Var. *pinonis* Elmer Bot. Gaz. 39 54 (1905) is *A. Hookerianus* var.
Tragacantha Whitneyi (Gray) Kuntze Rev. Gen. 2 (1891).
Phaca Whitneyi (Gray) Heller Muhl. 9 67 (1913).
Wilsoni Greene Pitt. 3 196 (1897) is *A. lentiginosus* var. *Mokiacensis*.
Wingatensis Watson Proc. Am. Acad. 18 192 (1883) No 1, p. 69.
Homalobus Wingatensis (Watson) Rydberg Torr. Bull. 31 563 (1904), also Heller Muhl. 1 145 (1906).
 Var. *Dodgeanus* Jones p. 69.
A. Dodgeanus Jones Cont. 3 289 (1893).
Homalobus Dodgeanus (Jones) Rydberg Torr. Bull. 40 52 (1913).
acerbus (Sheldon) Rydberg Torr. Bull. 32 666 (1905).
A. acerbus Sheldon Minn. Bot. Stud. 9 123 (1894).
Homalobus proximus Rydberg Torr. Bull. 32 667 (1905).
Williamsii Rydberg Bull. N. Y. Gard. 2 175 (1901).
Woodruffi No. 13, p. 77.
Wootoni Sheldon Minn. Bot. Stud. 9 138 (1894) is *A. subcinereus* Gray.
Wrightii Gray Pl. Lindheimer 176 (1850) No. 239, p. 269.
Tragacantha Wrightii (Gray) Kuntze Rev. Gen. 2 (1891).
Yaquianus Watson Proc. Am. Acad. 23 270 (1888) is *A. giganteus* var.
Yukonis Jones No. 28, p. 89.
Zionis Jones Cont. 7 652 (1895) No. 168, p. 208.
Xylophacos Zionis (Jones) Rydberg Torr. Bull. 40 48 (1913).

- Atelophragma* Rydberg Torr. Bull. 32 660 (1905) p. 15.
aboriginum (Rich.) Rydberg Torr. Bull. 32 660 (1905) is *A. aboriginum*.
Arthuri (Jones) Rydberg Torr. Bull. 40 51 (1913) is *A. Arthuri* Jones.
Brandegei (Porter) Rydberg Torr. Bull. 32 660 (1905) is *A. Brandegei*.
elegans (Hook.) Rydberg Torr. Bull. 32 660 (1905) is *A. elegans*.
Forwoodi (Watson) Rydberg Torr. Bull. 40 51 (1913) is *A. aboriginum* var.
glabriusculum (Hook.) Rydberg Torr. Bull. 32 660 (1905) is *A. aboriginum* var.
Ibapense (Jones) Rydberg Torr. Bull. 40 51 (1913) is *A. Ibapensis*.
lineare Rydberg Torr. Bull. 40 51 (1913) is *A. aboriginum* Rich.
Macounii Rydberg Torr. Bull. 32 660 (1905) is *A. Labradoricus* var.
Shearis Rydberg Torr. Bull. 32 660 (1905) is *A. elegans*.
- Atrati pp. 12, 179.
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Cnemidophacos Rydberg Torr. Bull. 32 663 (1905) p. 15.
argillosus (Jones) Rydberg Torr. Bull. 40 52 (1913) is *A. argillosus*.
confertiflorus (Gray) Rydberg Torr. Bull. 40 52 (1913) is *A. confertiflorus* Gray.
flavus (Nutt.) Rydberg Torr. Bull. 32 664 (1905) is *A. confertiflorus* Gray.
reventoides (Jones) Rydberg Torr. Bull. 40 52 (1913) is *A. terminalis* var.
reventus (Gray) Rydberg Torr. Bull. 40 52 (1913) is *A. reventus*.
 Collini pp. 11, 139.
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Ctenophyllum Rydberg Torr. Bull. 32 663 (1905) p. 16.
Grayi (Parry) Rydberg Torr. Bull. 40 50 (1913) is *A. Grayi* Parry.
pectinatus (Hook.) Rydberg Torr. Bull. 32 663 (1905) is *A. pectinatus*.
Cystium Stev. Bull. Soc. Nat. Mosc. 4 268 (1832) p. 16.
araneosum (Sheldon) Rydberg Torr. Bull. 40 50 (1913) is *A. lentiginosus* var.
Boiseanum (Nelson) Rydberg Torr. Bull. 40 50 (1913) is *A. arrectus* var.
Coulteri (Benth.) Rydberg Torr. Bull. 40 50 (1913) is *A. lentiginosus* var.
diphysum (Gray) Rydberg Torr. Bull. 32 659 (1905) is *A. lentiginosus* var.
ineptum (Gray) Rydberg Torr. Bull. 32 659 (1905). Republished

- lentiginosum (Dougl.) Ryd. Torr. Bull. 40 50 (1913) is *A. lentiginosus*.
 40 50 (1913) is *A. lentiginosus* var.
 platytropis (Gray) Rydberg Torr. Bull. 40 50 (1913) is *A. platytropis* Gr.
 Death Valley Region p. 53.
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 Diholcos Rydberg Torr. Bull. 32 664 (1905) p. 16.
 bisulcatus (Hook.) Rydberg Torr. Bull. 32 664 (1905) is *A. bisulcatus*.
 decalvans (Gandoger) Rydberg Torr. Bull. 32 664 (1905) is *A. bisulcatus*.
 Haydenianus (Gray) Rydberg Torr. Bull. 32 664 (1905) is *A. Haydenianus*.
 scobinatulus (Sheldon) Rydberg Torr. Bull. 40 51 (1913) is *A. Haydenianus*.
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 crassicarum (Nutt.) Rydberg in Small's Fl. S. E. U. S. 616 (1903) is *A. crassicarum*.
 Mexicanum (DC.) Rydberg in Small's Fl. S. E. U. S. 616 (1903) is *A. Mexicanum*.
 pachycarpum (T. & G.) Rydberg in Small's Fl. S. E. U. S. 616 (1903) is *A. crassicarum*.
 Plattense (Nutt.) Rydberg in Small's Fl. S. E. U. S. 615 (1903) is *A. Plattensis*.
 succulentum (Rich.) Rydberg Torr. Bull. 32 658 (1905) is *A. crassicarum*.
 Tennesseeense (Gray) Rydberg in Small's Fl. S. E. U. S. 616 (1903) is *A. Tennesseeense*.
 Green River Basin pp. 39, 43.
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 Hamosa Medic in Vorles Churpf. Phys. Ges. 2 376 (1787).
 atrata (Watson) Rydberg Torr. Bull. 34 48 (1907) is *A. atrata*.
 austrina Rydberg in Small's Fl. S. E. U. S. 618, 1332 (1903) is *A. Nuttallianus*.
 atratiformis Rydberg Torr. Bull. 34 48 (1907) is *A. straturensis* Jones.
 calycosa (Torr.) Rydberg Torr. Bull. 40 50 (1913) is *A. calycosus*.
 leptocarpa (T. & G.) Rydberg in Small's Fl. S. E. U. S. 617 (1903) is *A. leptocarpus*.
 Lindheimeri (Eng.) Rydberg in Small's Fl. S. E. U. S. 617 (1903) is *A. Lindheimeri*.
 macilenta Rydberg in Small's Fl. S. E. U. S. 617 (1903) is *A. leptocarpus*.

- Nuttalliana (DC.) Rydberg in Small's Fl. S. E. U. S. 618 (1903)
is *A. Nuttallianus*.
- scaposa (Gray) Rydberg Torr. Bull. 32 659 (1905) is *A. calycosus*
var.
- Hamosi p. 253.
- Hesperastragalus Heller Muhl. 2 86 (1906).
- compactus Heller Muhl. 2 218 (1906) is *A. dispermus*.
- didymocarpus (H. & A.) Heller Muhl. 2 87 (1905) is *A. didymo-*
carpus.
- Gambellianus (Sheldon) Heller Muhl. 2 87 (1905) is *A. nigrescens*.
- Homalobi pp. 11, 18, 65.
- Homalobus Nutt. in T. & G. Fl. 1 353 (1838).
- aboriginorum (Rich.) Rydberg Fl. Mont. 246 (1900) is *A. aborig-*
inum.
- aboriginum (Rich.) Rydberg in Britton's Man. 554 (1901) is *A.*
aboriginum.
- acerbus (Sheldon) Rydberg Torr. Bull. 32 666 (1905) is *A. Dod-*
geanus.
- aculeatus (Nelson) Rydberg Fl. Mont. 249 (1900) is *A. montanus*
var.
- Bourgovii (Gray) Rydberg Fl. Mont. 247 (1900) is *A. Bourgovii*.
- Californicus (Gray) Heller Muhl. 2 86 (1905) is *A. Californicus*.
- brachycarpus Nutt. in T. & G. Fl. 1 352 (1838) is *A. simplicifo-*
lius var.
- cæspitosus Nutt. in T. & G. Fl. 1 352 (1838) is *A. simplicifolius*
var.
- campestris Nutt. in T. & G. Fl. 1 351 (1838) is *A. campestris*.
- camporum Rydberg Torr. Bull. 32 666 (1905) is *A. campestris*.
- canescens Nutt. in T. & G. Fl. 1 352 (1838) is *A. simplicifolius* var.
- Clementis Rydberg Torr. Bull. 31 563 (1904) is *A. Labradoricus*
var.
- collinus (Dougl.) Rydberg Torr. Bull. 40 53 (1913) is *A. collinus*.
- curvicarpus (Sheldon) Heller Muhl. 2 86 (1905) is *A. Missouri-*
ensis.
- debilis (Nutt.) Rydberg Torr. Bull. 40 53 (1913) is *A. debilis*.
- decumbens (Nutt. in T. & G. Fl. 1 352 (1838) is *A. campestris* var.
- decumbens (Nutt.) in T. & G. Fl. 1 352 (1838) is *A. campestris*
- decurrens Rydberg Torr. Bull. 31 563 (1904) is *A. campestris* var.
- dispar Nutt. in T. & G. Fl. 1 350 (1838) is *A. tenellus*.
- divergens (Blankenship) Rydberg Torr. Bull. 34 417 (1907) is
A. campestris var.
- Dodgeanus (Jones) Rydberg Torr. Bull. 40 52 (1913) is *A. Winga-*
tensis var.
- Episcopus (Watson) Rydberg Torr. Bull. 40 53 (1913) is *A. Epis-*
copus.
- exilifolius (Nelson) Rydberg Torr. Bull. 40 52 (1913) is *A. sim-*
plicifolius var.
- Fendleri (Gray) Rydberg Torr. Bull. 32 667 (1905) is *A. flexuosus*
var.
- filipes (Torr.) Heller Muhl. 2 86 (1906) is *A. stenophyllus*.
- grallator (Watson) Rydberg Torr. Bull. 32 666 (1905) is *A. Hay-*
denianus.
- flexuosus (Hook.) Rydberg Torr. Bull. 32 666 (1905) is *A. flexu-*
osus.
- Hallii (Gray) Rydberg Torr. Bull. 32 667 (1905) is *A. gracilentus*
var.
- hylophilus Rydberg F. Mont. 247 (1900) is *A. campestris* var.
- junceus Nutt. in T. & G. Fl. 1 351 (1838) is *A. junceus*.
- junciformis (Nelson) Rydberg Torr. Bull. 32 666 (1905) is *A. junceus*
var.
- lancearius (Gray) Rydberg Torr. Bull. 40 52 (1913) is *A. lance-*
arius.
- lingulatus (Sheldon) Rydberg Torr. Bull. 40 52 (1913) is *A. sim-*
plicifolius.

- macrocarpus (Gray) Rydberg Torr. Bull. 32 667 (1905) is *A. lonchocarpus*.
- miser (Dougl.) Rydberg Torr. Bull. 40 52 (1913) is *A. miser*.
- montanus (Nutt.) Britton & Br. Fl. 2 306 (1897) is *A. montanus*.
- multiflorus (Pursh) Nutt. in T. & G. Fl. 1 351 (1838) is *A. tenellus*.
- nigrescens Nutt. in T. & G. Fl. 1 351 (1838) is *A. tenellus*.
- oblongifolius Rydberg Torr. Bull. 34 50 (1907) is *A. campestris*.
- orthocarpus Nutt. in T. & G. Fl. 1 351 (1838) is *A. junceus* var.
- Palliseri (Gray) Rydberg Fl. Mont. 248 (1900) is *A. campestris* var.
- proximus Rydberg Torr. Bull. 32 667 (1905) is *A. Wingatensis* var.
- Salidae Rydberg Torr. Bull. 32 667 (1905) is *A. campestris*.
- serotinus (Gray) Rydberg Fl. Mont. 248 (1900) is *A. campestris* var.
- simplicifolius (Nutt.) Rydberg Torr. Bull. 40 52 (1913) is *A. simplicifolius*.
- stenophyllus (T. & G.) Rydberg Fl. Mont. 249 (1900) is *A. stenophyllus*.
- strigosus (C. & F.) Rydberg Torr. Bull. 40 53 (1913) is *A. campestris* var.
- tenellus (Pursh) Britton & Br. Fl. 2 305 (1897) is *A. tenellus*.
- tenuifolius Nutt. in T. & G. Fl. 1 352 (1838) is *A. campestris* var.
- vexiliflexus (Sheldon) Rydberg Fl. Mont. 249 (1900) is *A. pauciflorus*.
- Wingatensis (Watson) Rydberg Torr. Bull. 31 563 (1904) is *A. Wingatensis*.
- Wolfii Rydberg Torr. Bull. 31 562 (1904) is *A. montanus*.
- Hypoglottidei p. 8.
- Hypoglottidens p. 14.
- Hypoglottides p. 169.
- Incani p. 8.
- Inflati pp. 11, 91.
- Jonesiella Rydberg Torr. Bull. 32 661 (1905).
- asclepiadoides* (Jones) Torr. Bull. 32 661 (1905) is *A. asclepiadoides*.
- Kentrophyta Nutt. in T. & G. Fl. 1 353 (1838) p. 16.
- aculeata* (Nelson) Rydberg Torr. Bull. 32 665 (1905) is *A. montanus* var.
- impersa* (Sheldon) Rydberg Torr. Bull. 32 665 (1905) is *A. montanus* var.
- montana* Nutt. in T. & G. Fl. 1 353 (1838) is *A. montanus*.
- tegetaria* (Watson) Rydberg Torr. Bull. 40 52 (1913) is *A. montanus* var.
- viridis* Nutt. in T. & G. Fl. 1 353 (1838) is *A. montanus*.
- Wolfii* Rydberg Torr. Bull. 32 665 (1905) is *A. montanus* var.
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- Lanocarpus p. 13.
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- Lower Temperate Life-Zone, pp. 31, 38, 50, 51, 52.
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- Mexican Plateau pp. 38, 39, 40, 44.
- Micranthi, pp. 9, 272.
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- Micropletes Rydberg Torr. Bull. 32 663 (1905) p. 16.
- gracilis* (Nutt.) Rydberg Torr. Bull. 32 663 (1905) is *A. parviflorus*.
- microlobus* (Gray) Rydberg Torr. Bull. 32 663 (1905) is *A. parviflorus*.

- parviflorus* (Pursh) Rydberg Torr. Bull. 40 51 (1913) is *A. parviflorus*.
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Mulfordæ (Jones) Rydberg Torr. Bull. 40 51 (1913) is *A. Mulfordæ*.
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Orophaca Britton in Br. & Br. Fl. 2 306 (1897).
aretioides (Jones) Rydberg Torr. Bull. 32 668 (1905) is *A. sericoleucus* var.
caespitosa (Nutt.) Britton in Br. & Br. Fl. 2 306 (1897) is *A. triphyllus*.
sericea (Nutt.) Britton in Br. & Br. Fl. 2 307 (1897) is *A. sericoleucus*.
tridactylica (Gray) Rydberg Torr. Bull. 32 668 (1905) is *A. sericoleucus* var.
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aboriginum (Rich.) Hook. Fl. Bor. Am. 1 143 (1830) is *A. aboriginum*.
adsurgens (Pall.) Piper Fl. Wash. 372 (1906) is *A. adsurgens*.
agrestis (Dougl.) Piper Fl. Wash. 372 (1906) is *A. agrestis*.
alpina (L.) Piper Fl. Wash. 371 (1906) is *A. Andinus* Nutt.
alpina L. 755 (1753) is *A. alpinus* Sheldon.
ampullaria (Watson) Rydberg Torr. Bull. 40 47 (1913) is *A. ampullarius*.
Andina Nutt. in T. & G. Fl. 1 345 (1838) is *A. Andinus*.
annua Geyer Lond. Jour. Bot. 6 213 (1847) is *A. Geyeri*.
argophylla Nutt. in T. & G. Fl. 1 342 (1838) is *A. triphyllus*.
arrecta (Gray) Piper Fl. Wash. 370 (1906) is *A. arrectus*.
Artemisiarum (Jones) Rydberg Torr. Bull. 40 48 (1913) is *A. Beckwithii*.
artipes (Gray) Rydberg Torr. Bull. 32 664 (1905) is *A. oophorus*.
astragalina DC. Ast. 52 (1802) is *A. Andinus*.
Beckwithii (T. & G.) Piper Fl. Wash. 371 (1906) is *A. Beckwithii*.
bisulcata Hook. Fl. Bor. Am. 1 145 (1834) is *A. bisulcatus*.
Bodini (Sheldon) Rydberg Torr. Bull. 32 665 (1905) is *A. debilis*.
brachycarpa (Nutt.) Britton Mem. Torr. Club 5 200 (1894) is *A. simplicifolius*.
cæspitosa Nutt. Gen. 2 98 (1818) is *A. triphyllus*.
Canadensis (L.) MacMillan Metasperm. 325 (1892) is *A. Canadensis*.

candidissima Benth. Bot. Sulph. 13 (1845) is *A. Magdalenæ*.
CanDolleana H. B. K. Nov. Gen. & Sp. 6 495 (1824) is *A. triflorus*.
canescens Nutt. in T. & G. Fl. 1 343 (1838) is *A. leucopsis*.
caryocarpa (Ker) MacMillan Metasperm. 326 (1892) is *A. cras-*
sicarpus.
cerussata (Sheldon) Rydberg Torr. Bull. 32 665 (1905) is *A.*
triflorus.
collina (Dougl.) Hook. Fl. Bor. Am. 1 141 (1830) is *A. collinus*.
conjuncta (Wat.) Piper Fl. Wash. 373 (1906) is *A. reventus* var.
convallaria (Greene) Piper Fl. Wash. 373 (1906) is *A. campestris*.
cretacea Buckley Proc. Phil. Acad. Ser. 2 5 452 (1862) is *A. Mis-*
souriensis.
Crotalariae Benth. Pl. Hartw. 307 (1848) is *A. Crotalariae*.
Cusickii (Gray) Rydberg Torr. Bull. 40 47 (1913) is *A. Cusickii*.
debilis Nutt. in T. & G. Fl. 1 345 (1838) is *A. debilis*.
decumbens (Nutt.) Piper Fl. Wash. 373 (1906) is *A. campestris*.
densifolia Smith in Rees Cycl. 27 No. 9 (1817) is *A. vestitus* var.
digitata Torr. Frem. Rep. 89 (1845) is *A. sericoleucus* var.
Douglasii T. & G. Fl. 1 346 (1838) is *A. Douglasii*.
Eastwoodæ (Jones) Rydberg Torr. Bull. 32 664 (1905) is *A.*
Preussii var.
elaticarpa (Sheldon) Rydberg Tor. Bull. 32 665 (1905) is *A.*
lotiflorus.
elegans Hook. Fl. Bor. Am. 1 144 (1830) is *A. elegans*.
elongata Hook. Fl. Bor. Am. 1 140 (1830) is *A. flexuosus*.
fastidia Kellogg Hesperian 4 145 (1860) is *A. leucopsis* var.
Fendleri Gray Pl. Fend. 36 (1849) is *A. flexuosus* var.
flexuosa Hook. Fl. Bor. Am. 1 141 (1830) is *A. flexuosus*.
Franciscana (Sheldon) Heller Muhl. 2 217 (1906) is *A. vestitus*
var.
glabriuscula Hook. Fl. Bor. Am. 1 144 (1830) is *A. aboriginum* var.
glareosa (Dougl.) Piper Fl. Wash. 369 (1906) is *A. glareosus*.
gracilentata Gray Pl. Fend. 36 (1849) is *A. gracilentus*.
gracilis (Nutt.) MacMillan Metasperm. 325 (1892) is *A. parvi-*
florus.
Hoodiana (Howell) Piper Fl. Wash. 373 (1906) is *A. reventus* var.
Hookeriana T. & G. Fl. 1 693 (1840) is *A. Hookerianus*.
humillima (Watson) Rydberg Torr. Bull. 32 665 (1905) is *A. hu-*
millimus.
Hypoglottis (L.) MacMillan Metasperm. 324 (1892) is *A. Hypo-*
glottis.
inepta (Gray) Rydberg Fl. Mont. 246 (1900) is *A. lentiginosus*.
inflexa (Dougl.) Piper Fl. Wash. 369 (1906) is *A. inflexus*.
jejuna (Watson) Rydberg Torr. Bull. 40 48 (1913) is *A. jejunua*.
lentiginosa (Dougl.) Piper Fl. Wash. 368 (1906) is *A. lentiginosus*.
leptalea (Gray) Rydberg Torr. Bull. 40 48 (1913) is *A. leptaleus*.
leucoloba (Jones) Heller Muhl. 2 85 (1905) is *A. Purshii* var.
leucophylla (T. & G.) H. & A. Bot. Beech. 333 (1841) is *A. leuco-*
phyllus.
leucopsis T. & G. Fl. 1 694 (1840) is *A. leucopsis*.
longifolia (Pursh) Nutt. in T. & G. Fl. 1 346 (1838) is *A. pictus*.
lotiflora (Hook.) T. & G. Fl. 1 349 (1838) is *A. lotiflorus*.
Lyallii (Gray) Piper Fl. Wash. 370 (1906) is *A. Lyallii*.
macrocarpa Gray Pl. Fend 36 (1849) is *A. lonchocarpus*.
macrodon H. & A. Bot. Beech. 333 (1841) is *A. macrodon*.
mégacarpa Nutt. in T. & G. Fl. 1 343 (1838) is *A. megacarpus*.
microcystis (Gray) Rydberg Fl. Mont. 245 (1900) is *A. miser*.
misella (Watson) Piper Fl. Wash. 371 (1906) is *A. Howellii* var.
miser (Dougl.) Piper Fl. Wash. 373 (1906) is *A. miser*.
mollis H. B. K. Nov. Gen. & Sp. 6 494 (1824) is *A. Humboldtii*.
mollissima Nutt. in T. & G. Fl. 1 350 (1838) is *A. Purshii*.
Mortoni (Nutt.) Piper Fl. Wash. 372 (1906) is *A. Canadensis* var.
neglecta T. & G. Fl. 1 344 (1838) is *A. neglectus*.

- nigrescens Hook. Fl. Bor. Am. 1 143 (1830) is *A. tenellus*.
 Nuttallii T. & G. Fl. 1 343 (1838) is *A. vestitus* var.
 oxyphysa (Gray) Heller Muhl. 2 86 (1905) is *A. oxyphysus*.
 parviflora Nutt. in T. & G. Fl. 1 348 (1838) is *A. elegans*.
 parvifolia Nutt. in T. & G. Fl. 1 348 (1838) is *A. parviflorus*.
 pauciflora Nutt. in T. & G. Fl. 1 348 (1838) is *A. leptaleus*.
 pectinata Hook. Fl. Bor. Am. 1 141 (1830) is *A. pectinatus*.
 picta Gray Pl. Fend. 37 (1849) is *A. pictus*.
 Plattensis (Nutt.) MacMillan Metasperm. 225 (1892) is *A. Plattensis*.
 platytropis (Gray) Rydberg Fl. Mont. 246 (1900) is *A. platytropis*.
 podocarpa Hook. Fl. Bor. Am. 1 142 (1830) is *A. sclerocarpus*.
 Preussii (Gray) Rydberg Torr. Bull. 40 47 (1913) is *A. Preussii*.
 pubentissima (T. & G.) Rydberg Torr. Bull. 40 48 (1913) is *A. pubentissimus*.
 Purshii (Dougl.) Piper Fl. Wash. 369 (1906) is *A. Purshii*.
 pygmæa Nutt. in T. & G. Fl. 1 349 (1838) is *A. pygmæus*.
 reventa (Gray) Piper Fl. Wash. 372 (1906) is *A. reventus*.
 Var. Canbyi (Jones) Piper Fl. Wash. 373 (1906) is *A. reventus*.
 Reverchoni (Gray) Rydberg in Small's Fl. S. E. U. S. 619 (1903) is *A. lotiflorus*.
 Robbinsii Oakes in Hovey's Mag. 7 181 (1841) is *A. Labradoricus* var.
 sabulonum (Gray) Rydberg Torr. Bull. 40 47 (1913) is *A. sabulonum*.
 sericea Nutt. in T. & G. Fl. 1 343 (1838) is *A. sericoleucus*.
 serotina (Gray) Piper Fl. Wash. 374 (1906) is *A. campestris* var.
 sesquiflora (Watson) Rydberg Torr. Bull. 40 48 (1913) is *A. sesquiflorus*.
 Silerana (Jones) Rydberg Torr. Bull. 40 47 (1913) is *A. Sileranus*.
 simplicifolia Nutt. in T. & G. Fl. 1 350 (1838) is *A. simplicifolius*.
 sinuatus Piper Fl. Wash. 370 (1906) is *A. Gibbsii*.
 Spaldingii (Gray) Piper Fl. Wash. 370 (1906) is *A. Spaldingii*.
 speirocarpa (Gray) Piper Fl. Wash. 370 (1906) is *A. speirocarpus*.
 stenophylla (T. & G.) Piper Fl. Wash. 371 (1906) is *A. stenophyllus*.
 subcinerea (Gray) Rydberg Torr. Bull. 40 47 (1913) is *A. subcinereus*.
 succumbens (Dougl.) Piper Fl. Wash. 370 (1906) is *A. succumbens*.
 Suksdorfii (Howell) Piper Fl. Wash. 369 (1906) is *A. Pulsiferæ*.
 Tejonensis (Jones) Heller Muhl. 2 85 (1905) is *A. Douglasii* var.
 trochopoda Nutt. in T. & G. Fl. 1 343 (1838) is *A. trichopodus*.
 triflora DC. Ast. 50 (1802) is *A. triflorus*.
 triphylla (Pursh) Eat. & Wr. Bot. Ed. 8 351 (1840) is *A. triphyllus*.
 Tweedyi (Canby) Piper Fl. Wash. 371 (1906) is *A. Tweedyi*.
 vestita Benth. Bot. Sulph. 13 (1844) is *A. vestitus*.
 villosa (Mx.) Nutt. Gen. 2 97 (1818) is *A. villosus* Mx.
 villosa James Cat. 186 (1825) is *A. mollissimus*.
 viridis (Nutt.) Britton Mem. Torr. Club. 5 201 (1894) is *A. montanus*.
 viridis (Nutt.) Piper Fl. Wash. 374 (1906) is *A. montanus*.
 Wardi (Gray) Rydberg Torr. Bull. 40 47 (1913) is *A. Wardi*.
 Wetherilli (Jones) Rydberg Torr. Bull. 32 665 (1905) is *A. Wetherilli*.
 Whitneyi (Gray) Heller Muhl. 9 67 (1913) is *A. Hookerianus* var.
 Phacopsis Rydberg Torr. Bull. 32 661 (1905) p. 16.
 Pattersoni (Gray) Rydberg Torr. Bull. 32 661 (1905) is *A. Pattersoni*.
 praelongus (Sheldon) Rydberg Torr. Bull. 32 661 (1905) is *A. Pattersoni* var.

- scaphoides (Jones) Rydberg Torr. Bull. 40 52 (1913) is *A. arrectus* var.
- Physondra dispar (Nutt.) Raf. Atl. Jour. 145 (1832) is *A. tenellus*.
 longifolia (Pursh) Raf. Atl. Jour. 145 (1832) is *A. pictus*.
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 alpinum (L.) Rydberg Torr. Bull. 32 659 (1905) is *A. Andinus*.
 arrectum (Gray) Rydberg Torr. Bull. 40 49 (1913) is *A. arrectus*.
 atropubescens (C. & F.) Rydberg Torr. Bull. 40 49 (1913) is *A. arrectus*.
 desperatum (Jones) Rydberg Torr. Bull. 32 660 (1905) is *A. desperatus*.
 distortum (T. & G.) Rydberg in Small's Fl. S. E. U. S. 619 (1903) is *A. distortus*.
 Drummondii (Dougl.) Rydberg Torr. Bull. 32 659 (1905) is *A. Drummondii*.
 eremiticum (Sheldon) Rydberg Torr. Bull. 40 49 (1913) is *A. arrectus* var.
 intonsum (Sheldon) Rydberg in Small's Fl. S. E. U. S. 619 (1903) is *A. villosus*.
 humistratum (Gray) Rydberg Torr. Bull. 32 660 (1905) is *A. humistratus*.
 obcordatum (Ell.) Rydberg in Small's Fl. S. E. U. S. 619 (1903) is *A. obcordatus*.
 racemosum (Pursh) Rydberg Torr. Bull. 32 659 (1905).
 scopulorum (Porter) Rydberg Torr. Bull. 32 659 (1905) is *A. scopulorum*.
 sparsiflorum (Gray) Rydberg Torr. Bull. 32 660 (1905) is *A. sparsiflorus*.
 variegatum Rydberg Torr. Bull. 34 47 (1907) is *A. sparsiflorus*.
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- Tragacantha. All the species of *Astragalus* not in *Phaca* were re-named as *Tragacanthæ* by Kuntze Rev. Gen 2 (1891) but

have not been recognized. This useless synonymy is not repeated here.

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argophyllus (Nutt.) Rydberg Torr. Bull. 34 49 (1907) is *A. argophyllus*.

cibarius (Sheldon) Rydberg Torr. Bull. 34 49 (1907) is *A. cibarius*.

coccineus (Parry) Heller Muhl. 2 217 (1906) is *A. coccineus*.

consectus (Sheldon) Rydberg Torr. Bull. 40 49 (1913) is *A. Purshii*.

cuspidocarpus (Sheldon) Rydberg Torr. Bull. 40 48 (1913) is *A. Missouriensis*.

cymboides (Jones) Rydberg Torr. Bull. 40 49 (1913) is *A. cymboides*.

inflexus (Dougl.) Rydberg Torr. Bull. 40 49 (1913) is *A. inflexus*.

Missouriensis (Nutt.) Rydberg Torr. Bull. in Small's Fl. S. E. U. S. 620 (1903) is *A. Missouriensis*.

Musiniensis (Jones) Rydberg Torr. Bull. 40 49 (1913) is *A. Musiniensis*.

Newberryi (Gray) Rydberg Torr. Bull. 32 662 (1905) is *A. Newberryi*.

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Purshii (Dougl.) Rydberg Torr. Bull. 32 662 (1905) is *A. Purshii*.

pygmæus (Nutt.) Rydberg Torr. Bull. 32 662 (1905) is *A. pygmæus*.

Shortianus (Nutt.) Rydberg in Small's Fl. S. E. U. S. 1332 (1903) is *A. Shortianus*.

Uintensis (Jones) Rydberg Torr. Bull. 32 662 (1905) is *A. argophyllus*.

Utahensis (Torr.) Rydberg Torr. Bull. 40 49 (1913) is *A. Utahensis*.

vespertinus (Sheldon) Rydberg Torr. Bull. 32 662 (1905) is *A. amphioxys* var.

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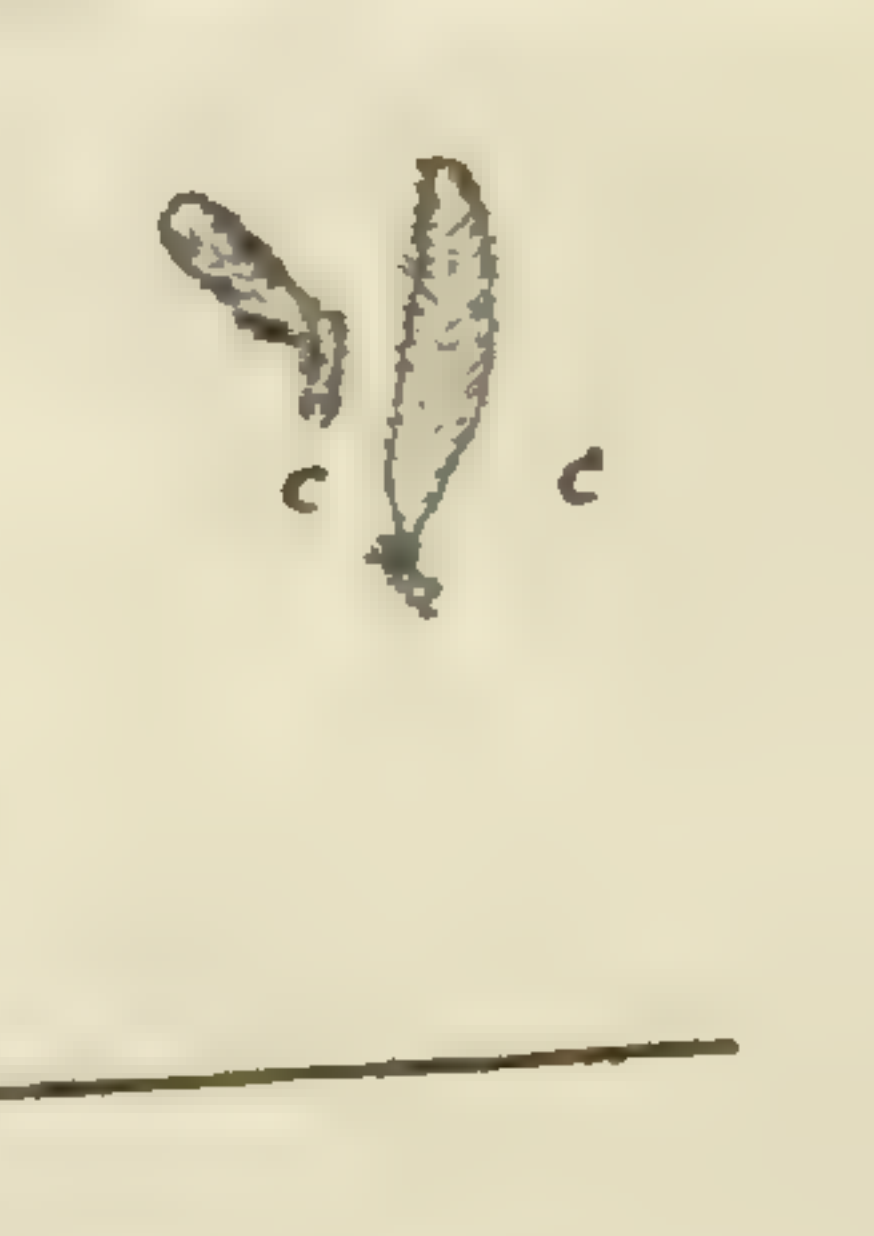
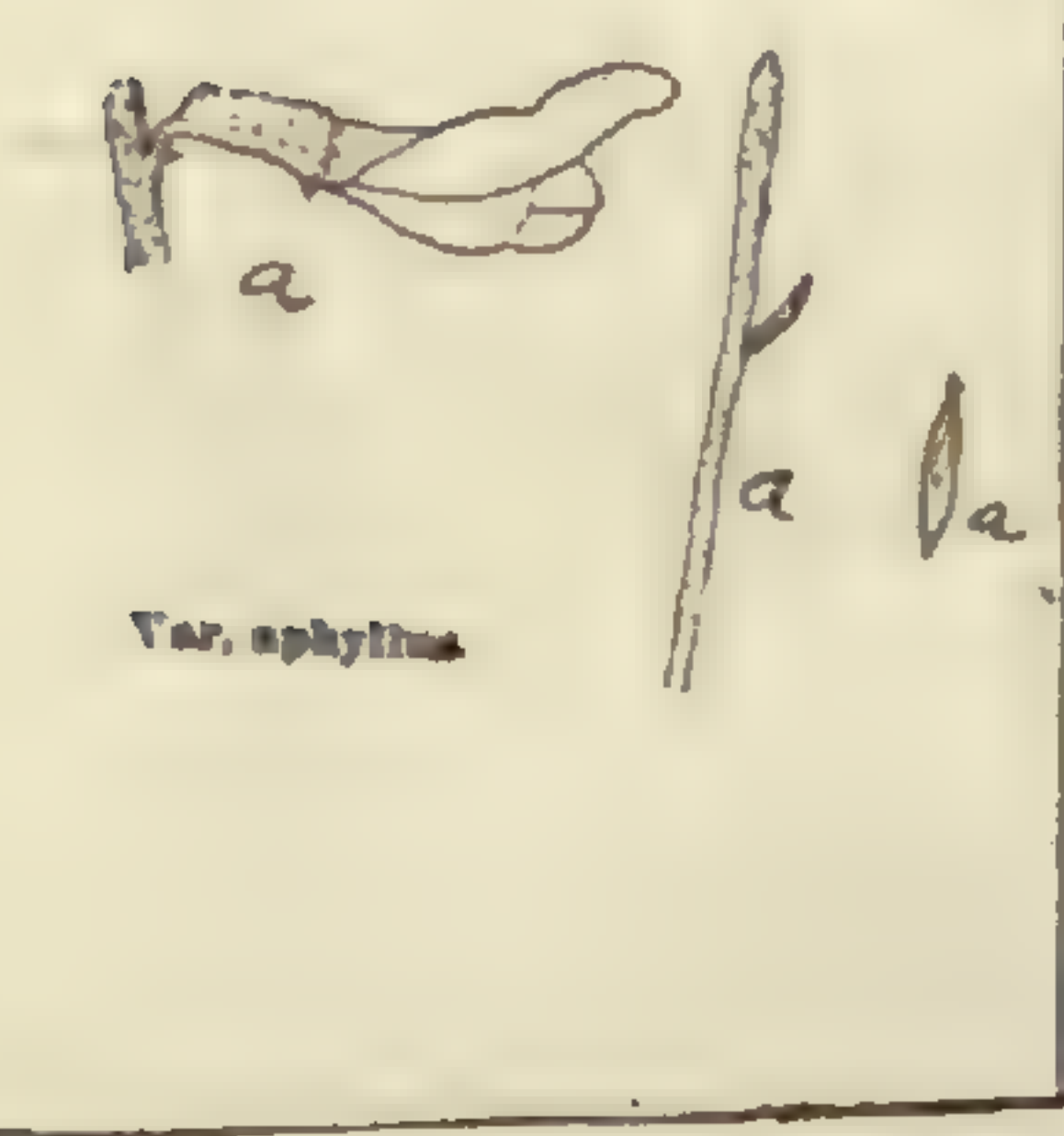
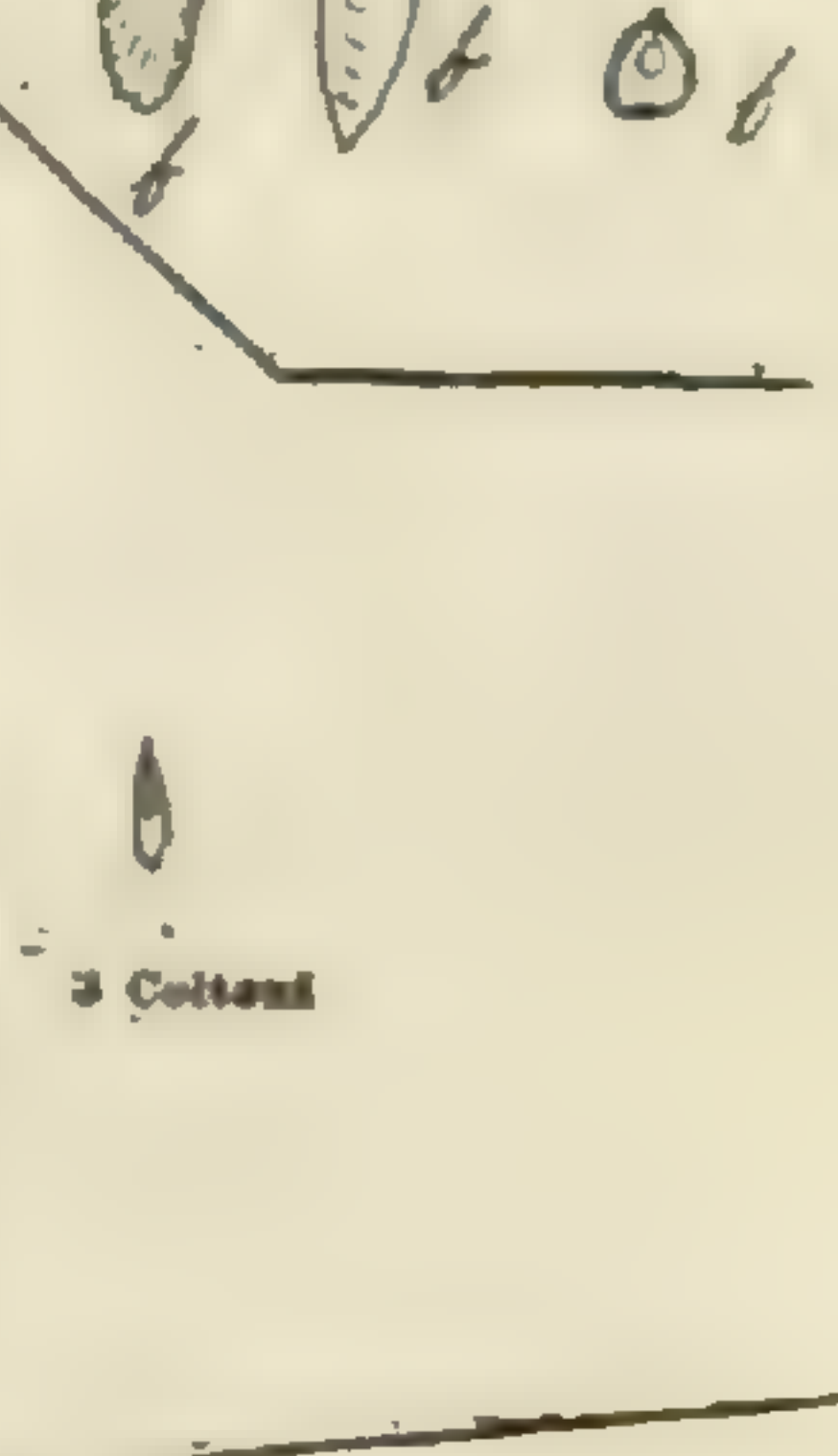
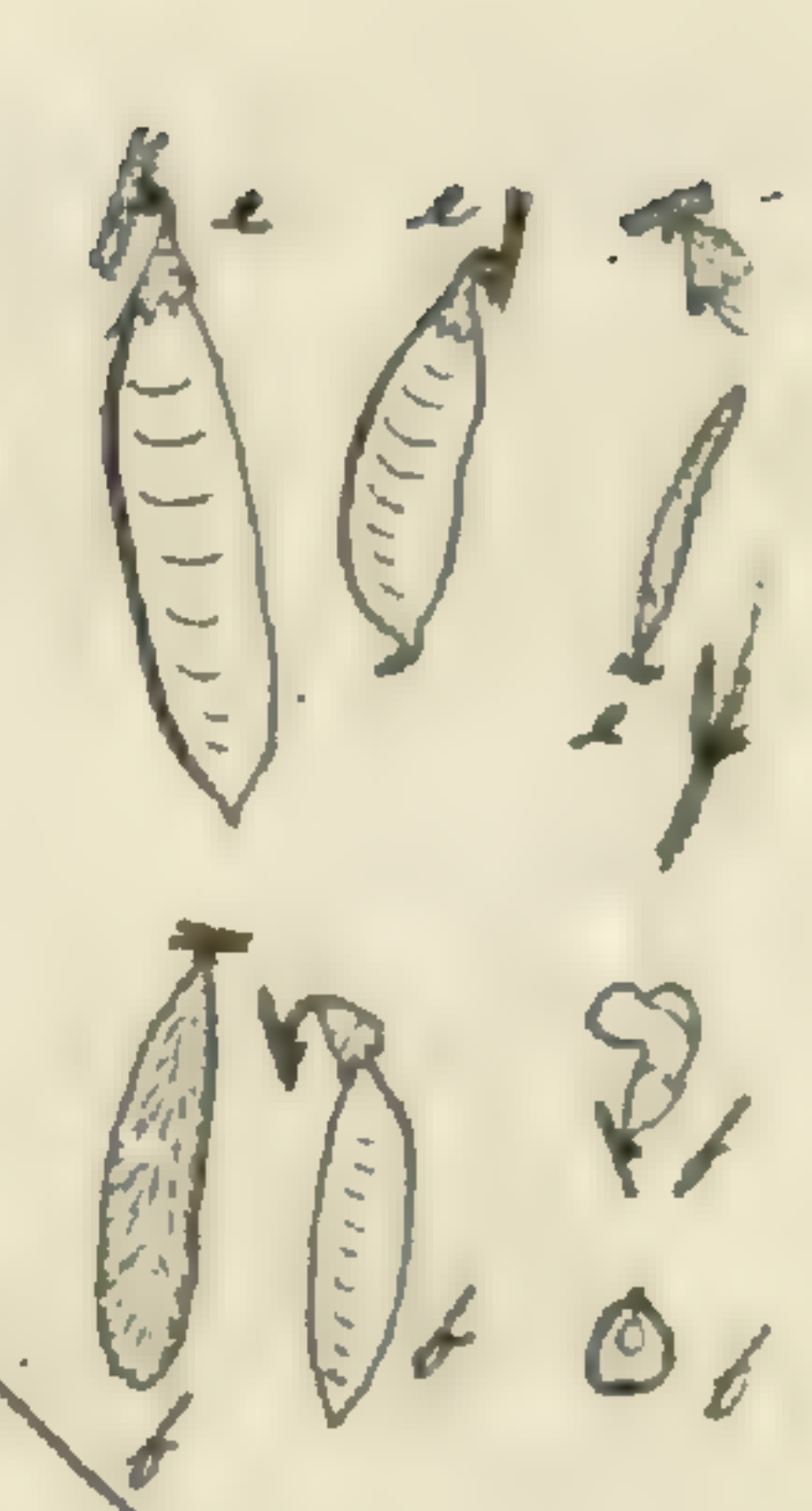
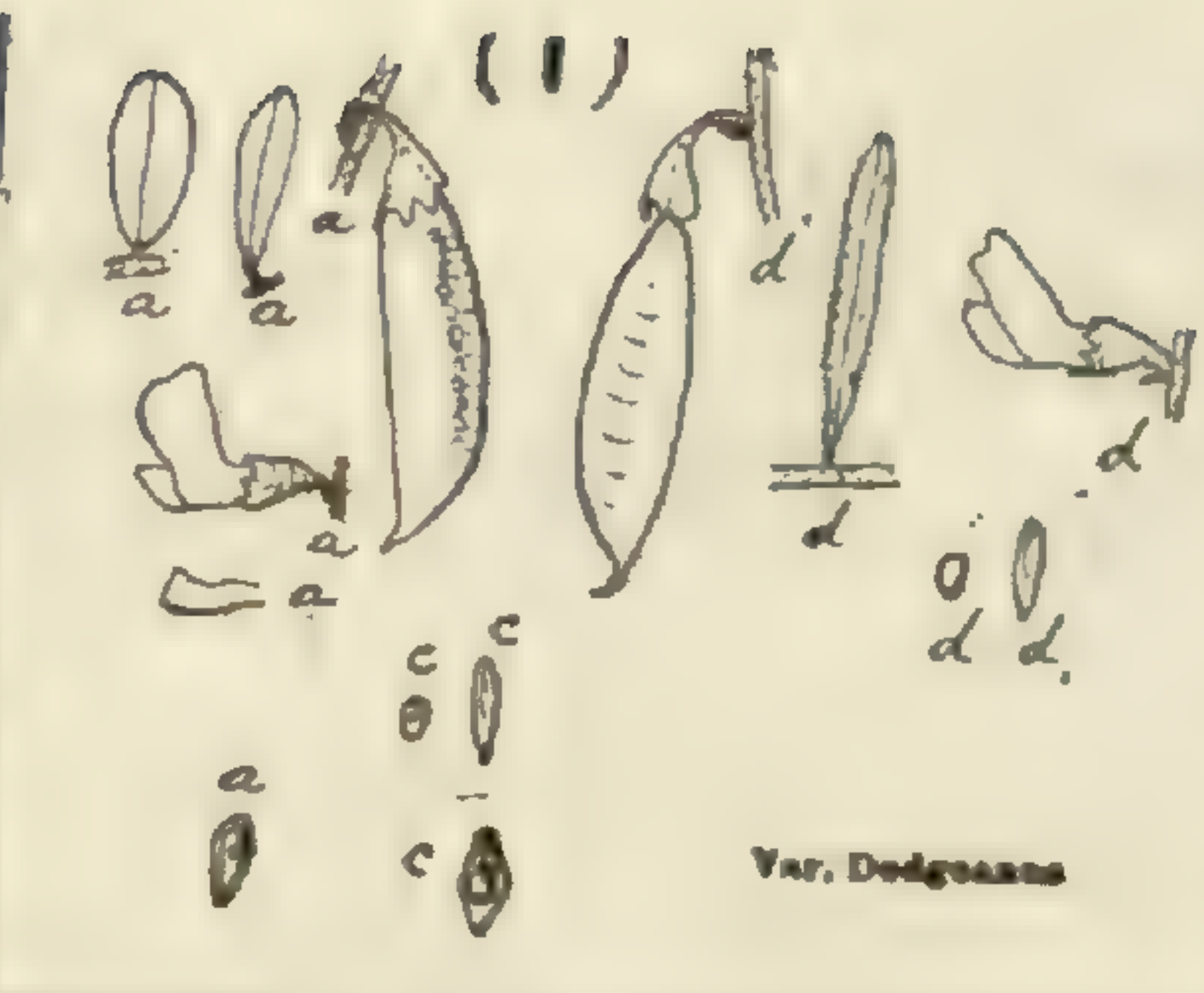
- oophorus*. 21. "a" fresh from Mammoth Utah.
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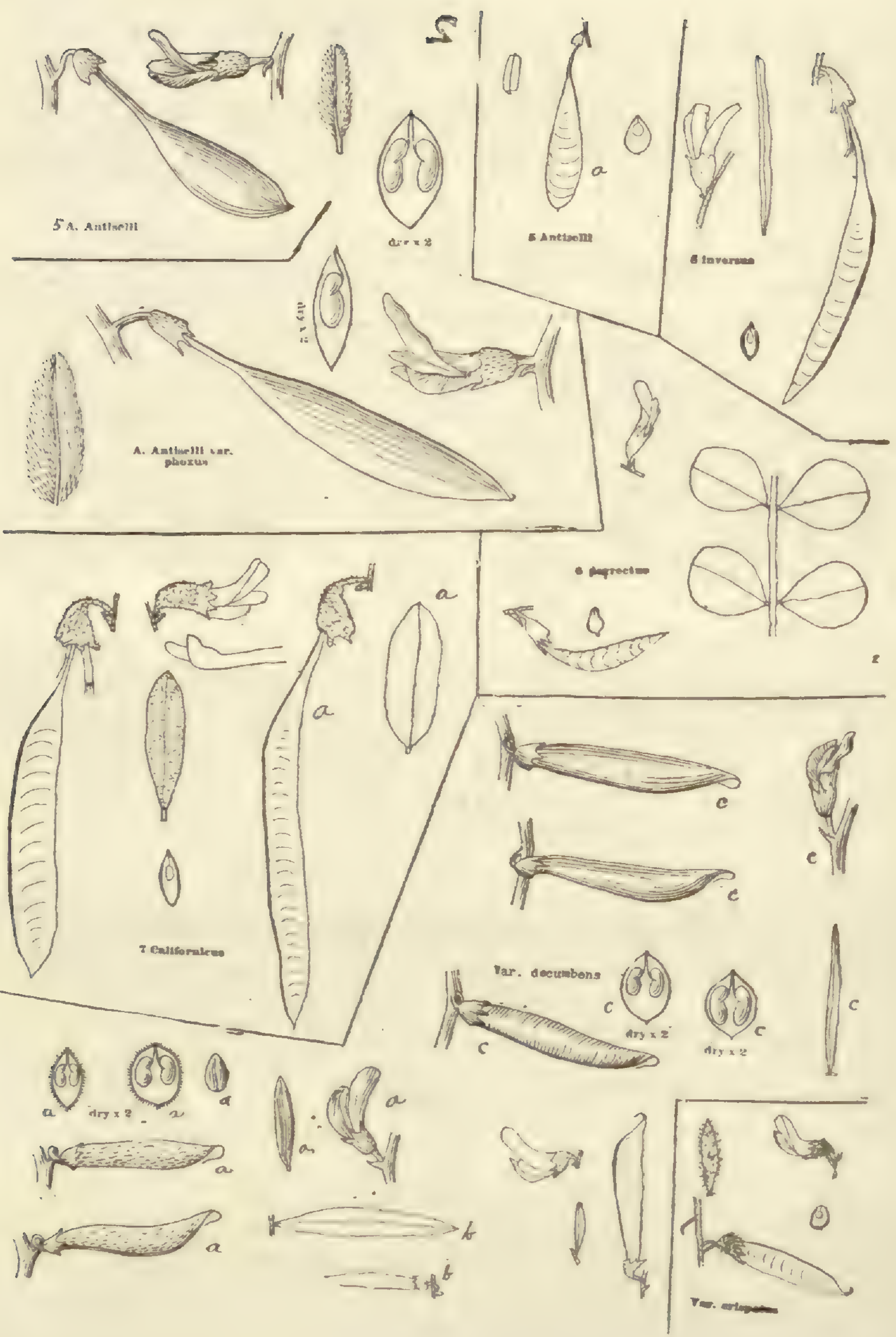
- pygmaeus. 49. "a" fresh. "c" inner skin. "d" outer skin.
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ADDENDA.

bicristatus var. tetrapteroides 78
 Cimensis 78
 Pattersoni var. procerus 78
 Zionis 78





(3)



V. campestris



Var. *hylophilus*



seed



dry x 2



Var. *serotinus*



d



d



d



d

V. campestris



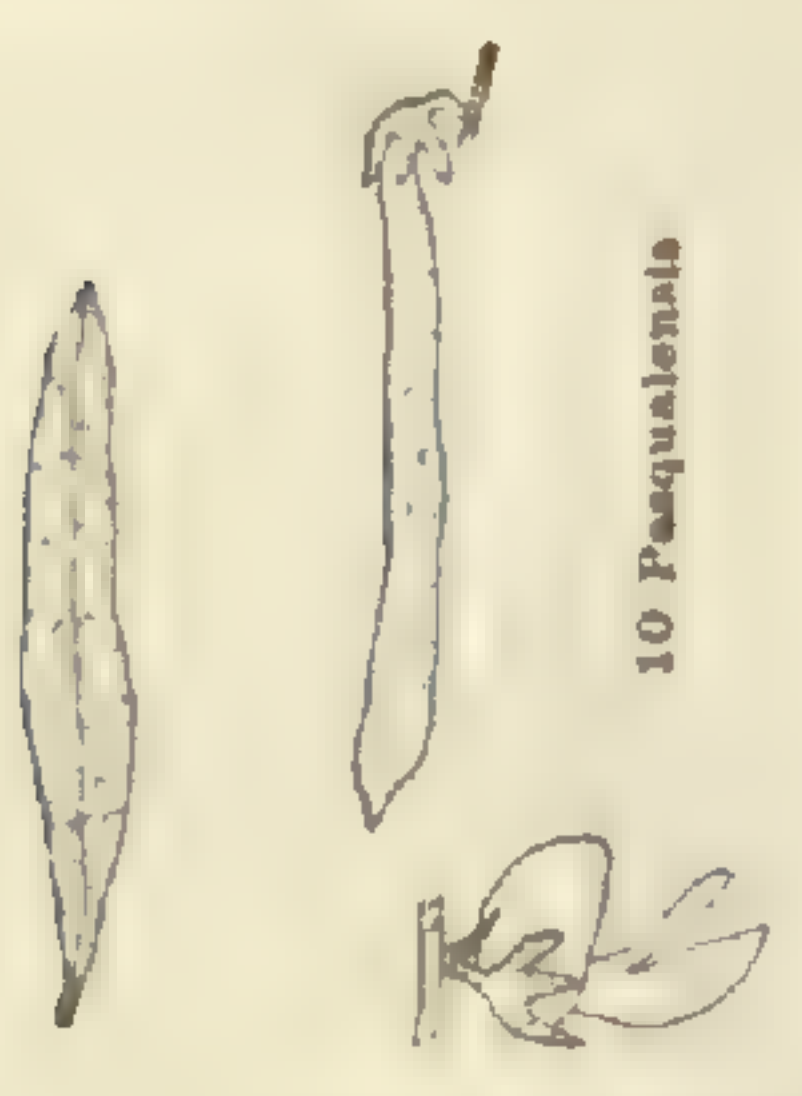
e



e



e



10 *Pasqualensis*



x 1



Var. *orthocarpus*



dry x 2



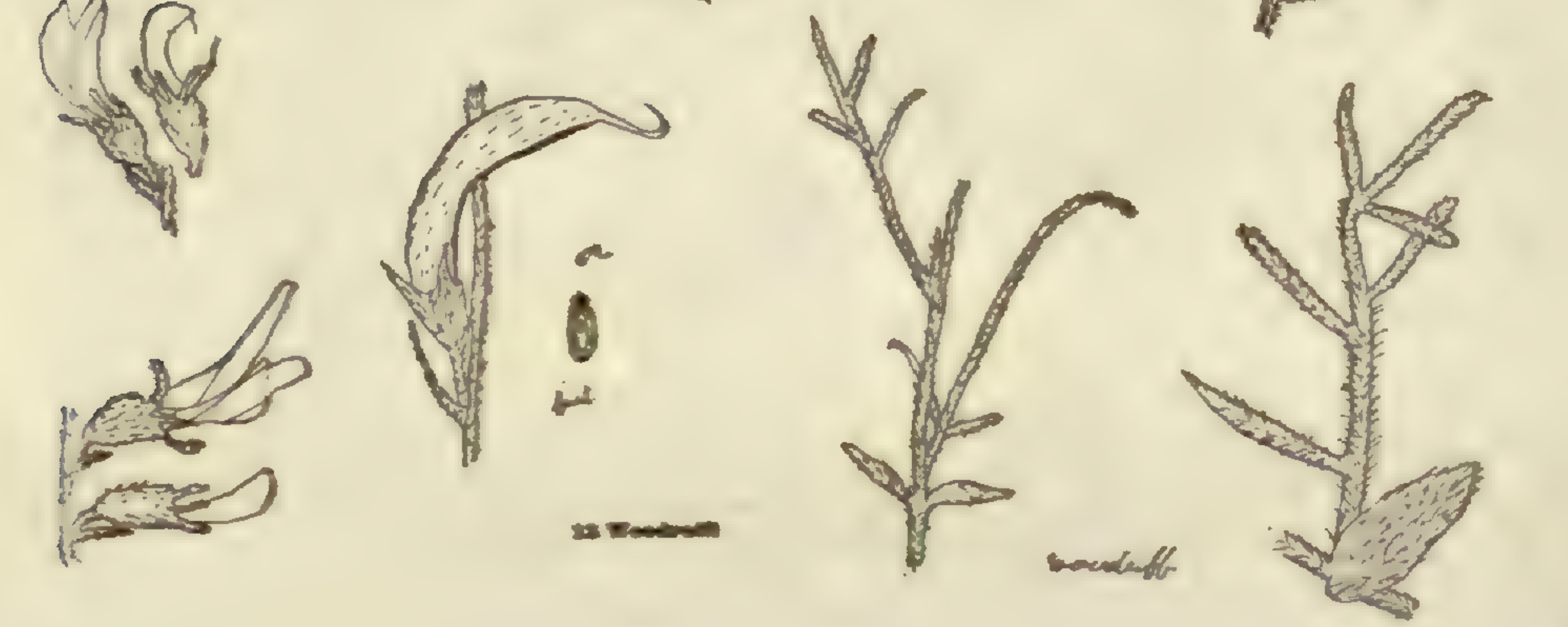
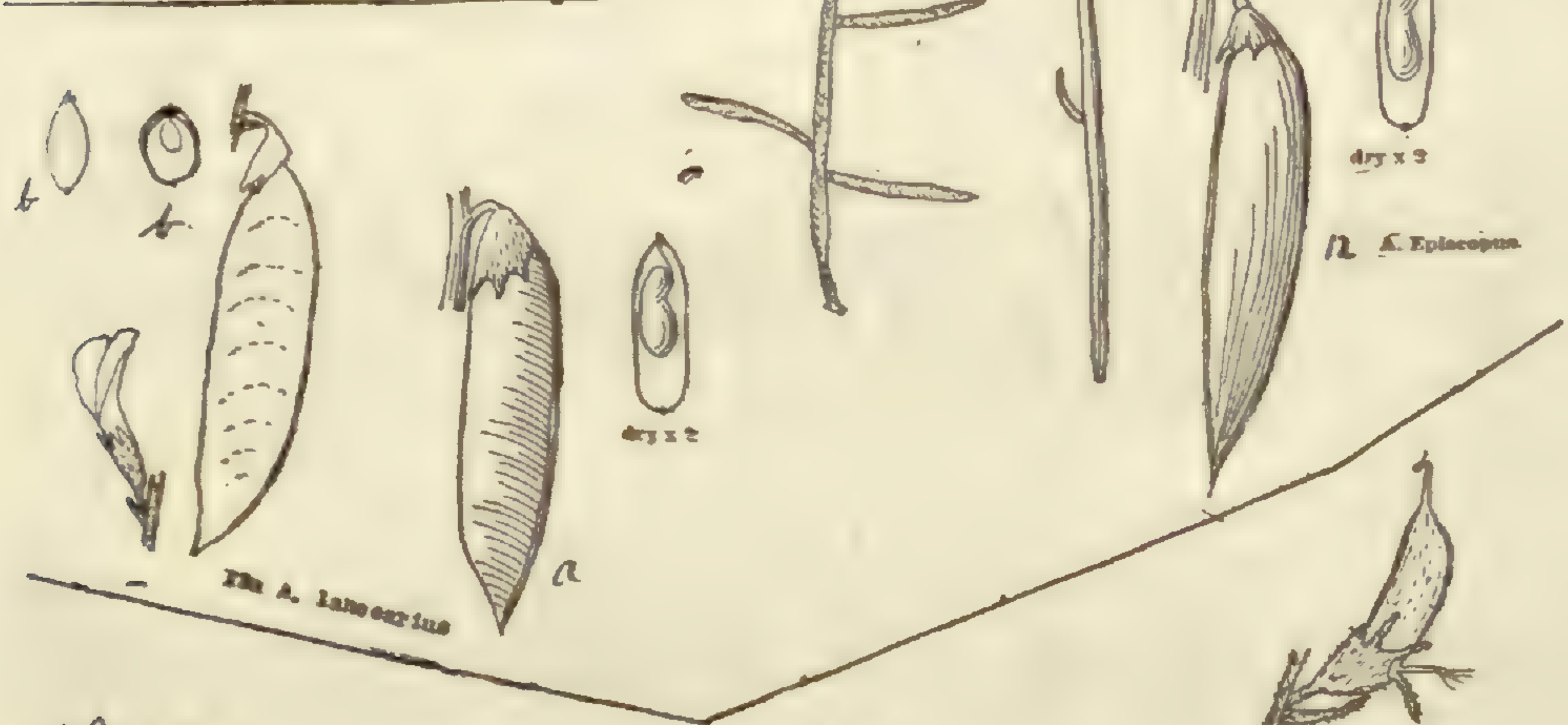
11 *juncus*



fresh x 2



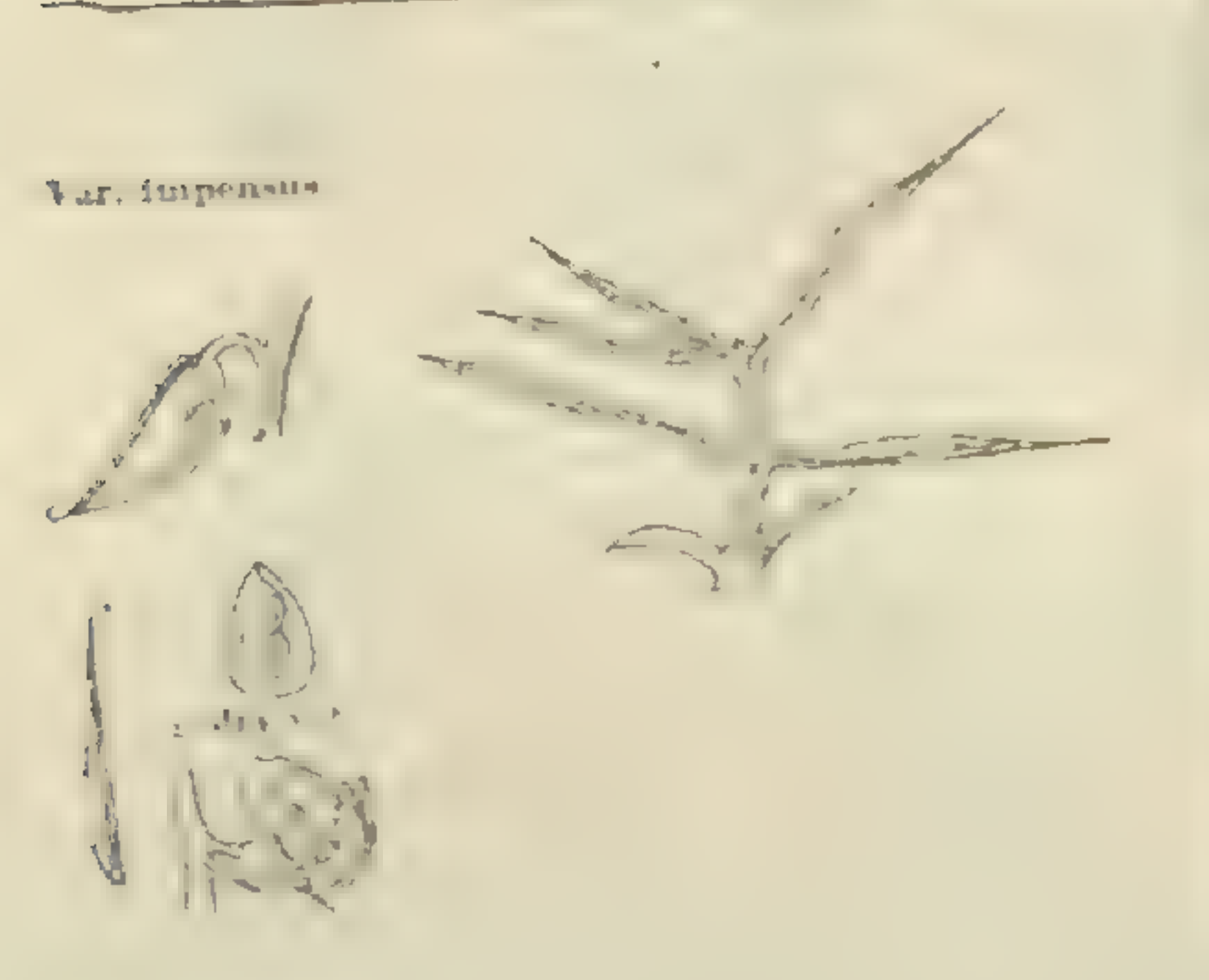
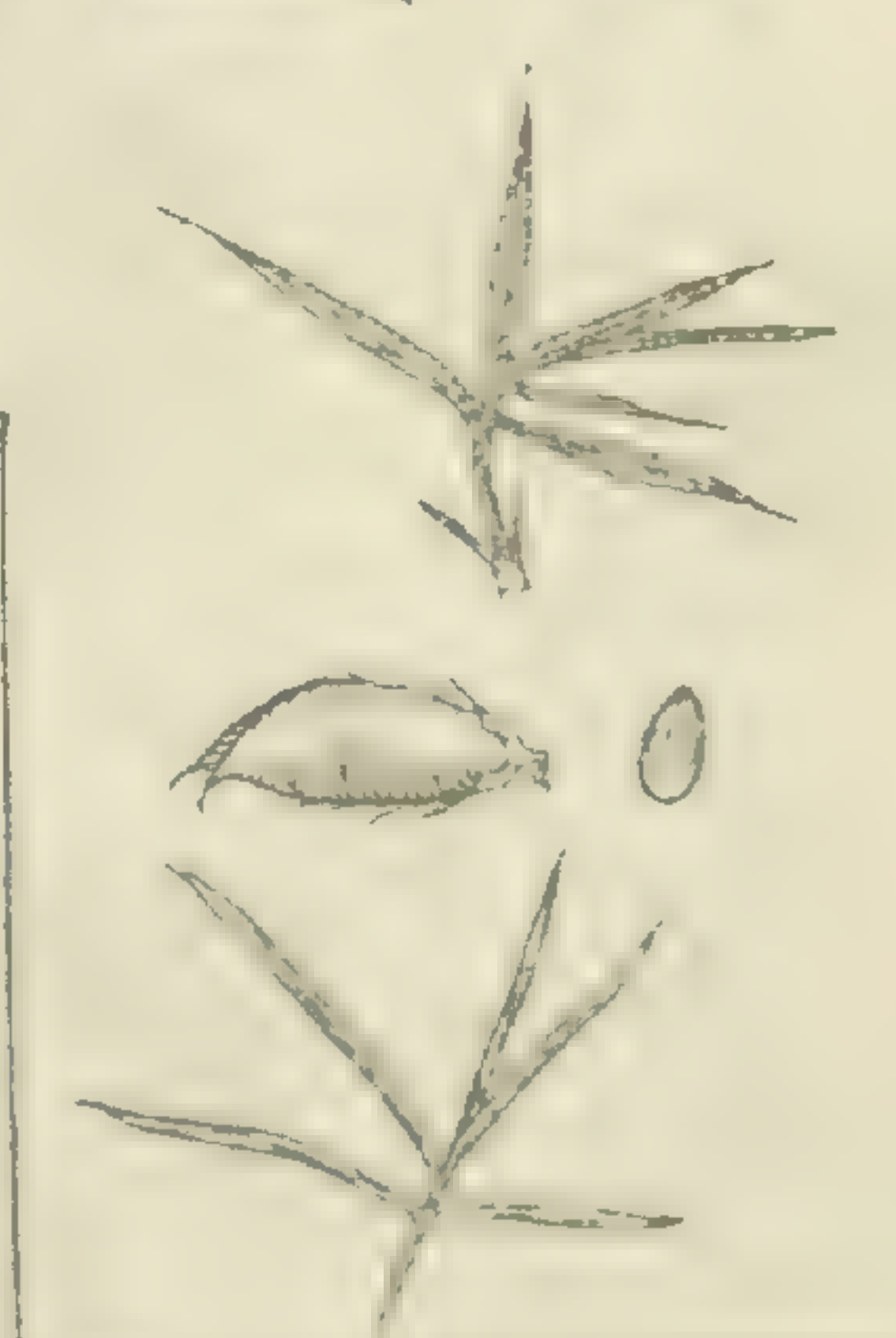
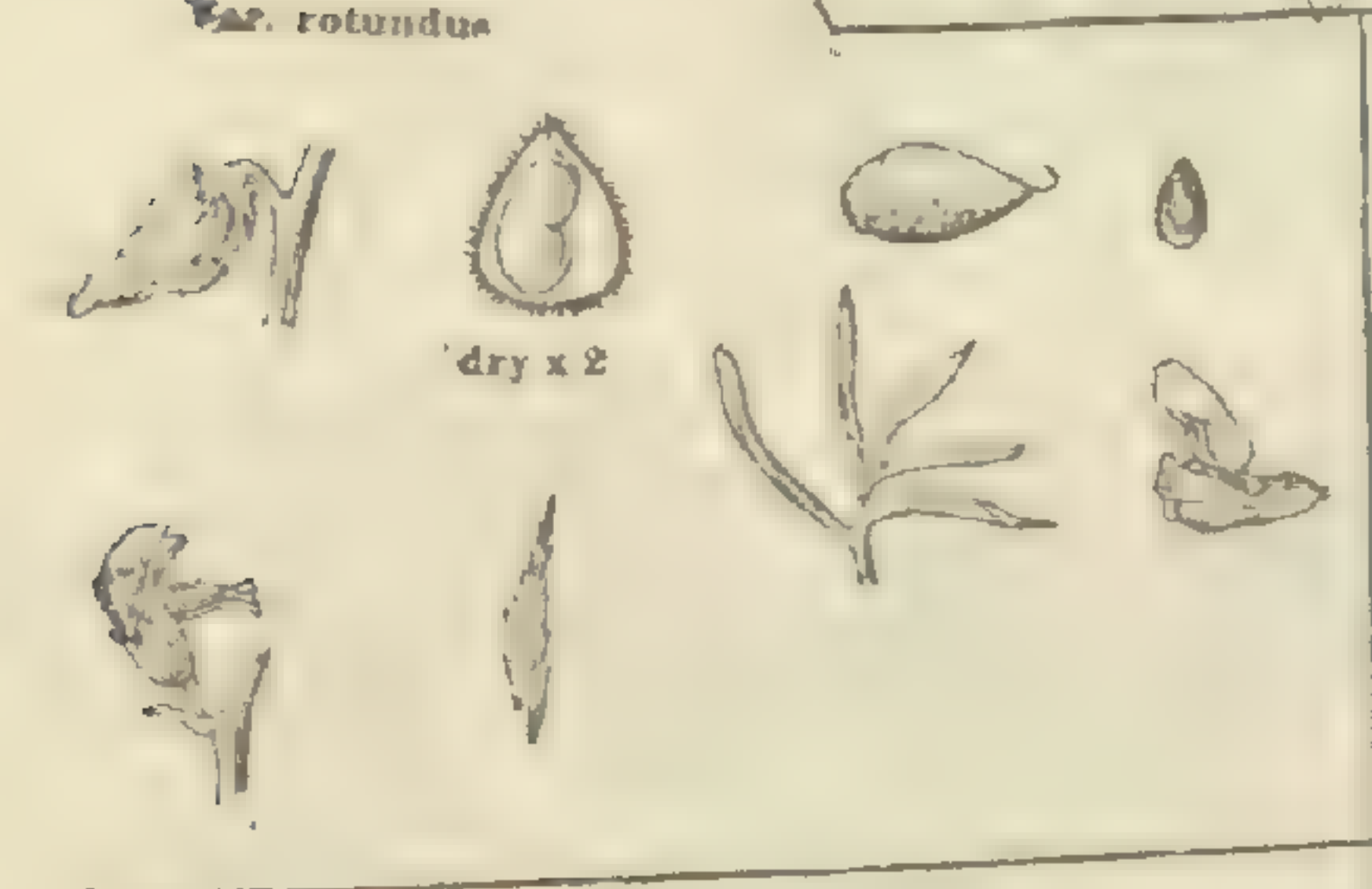
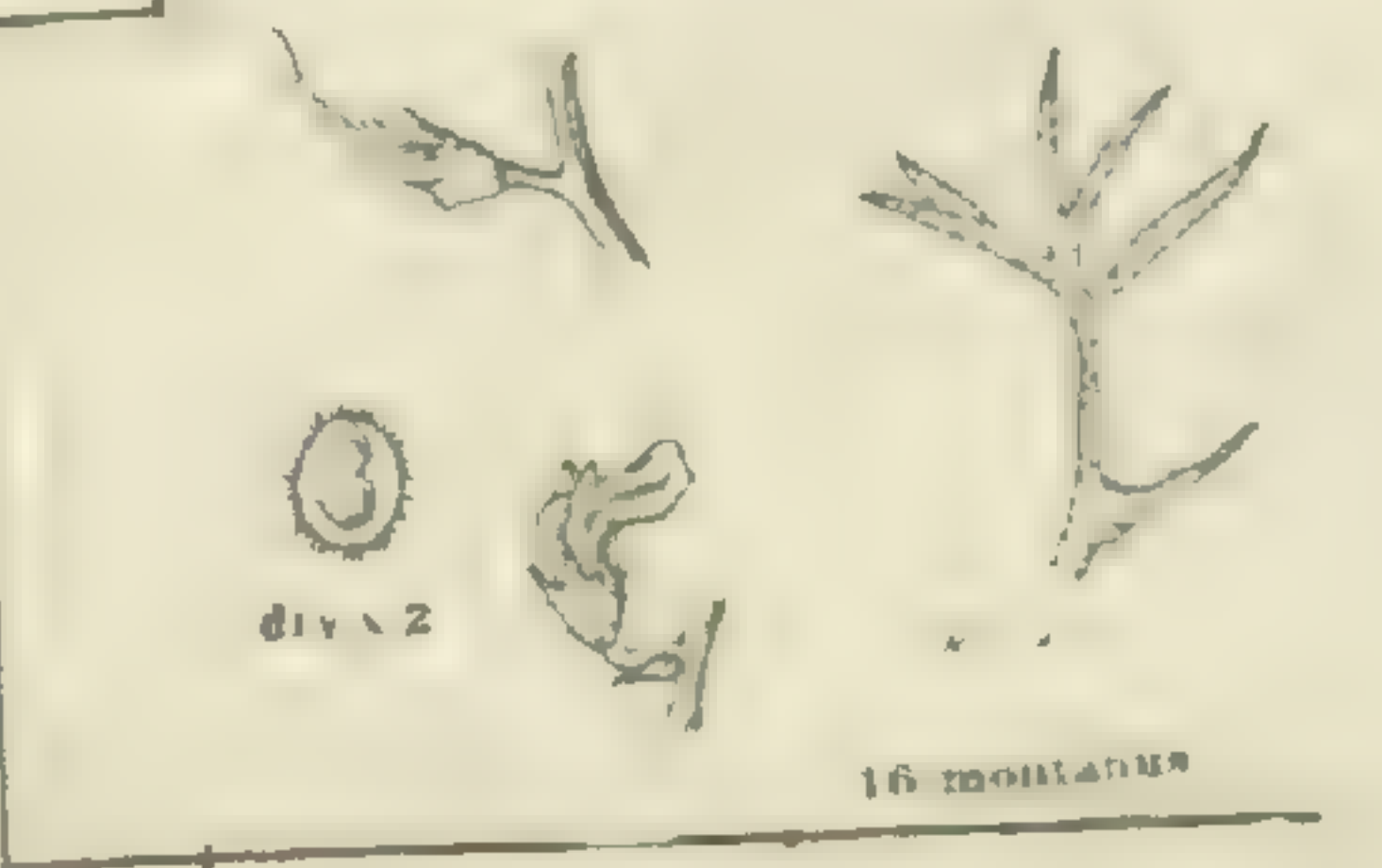
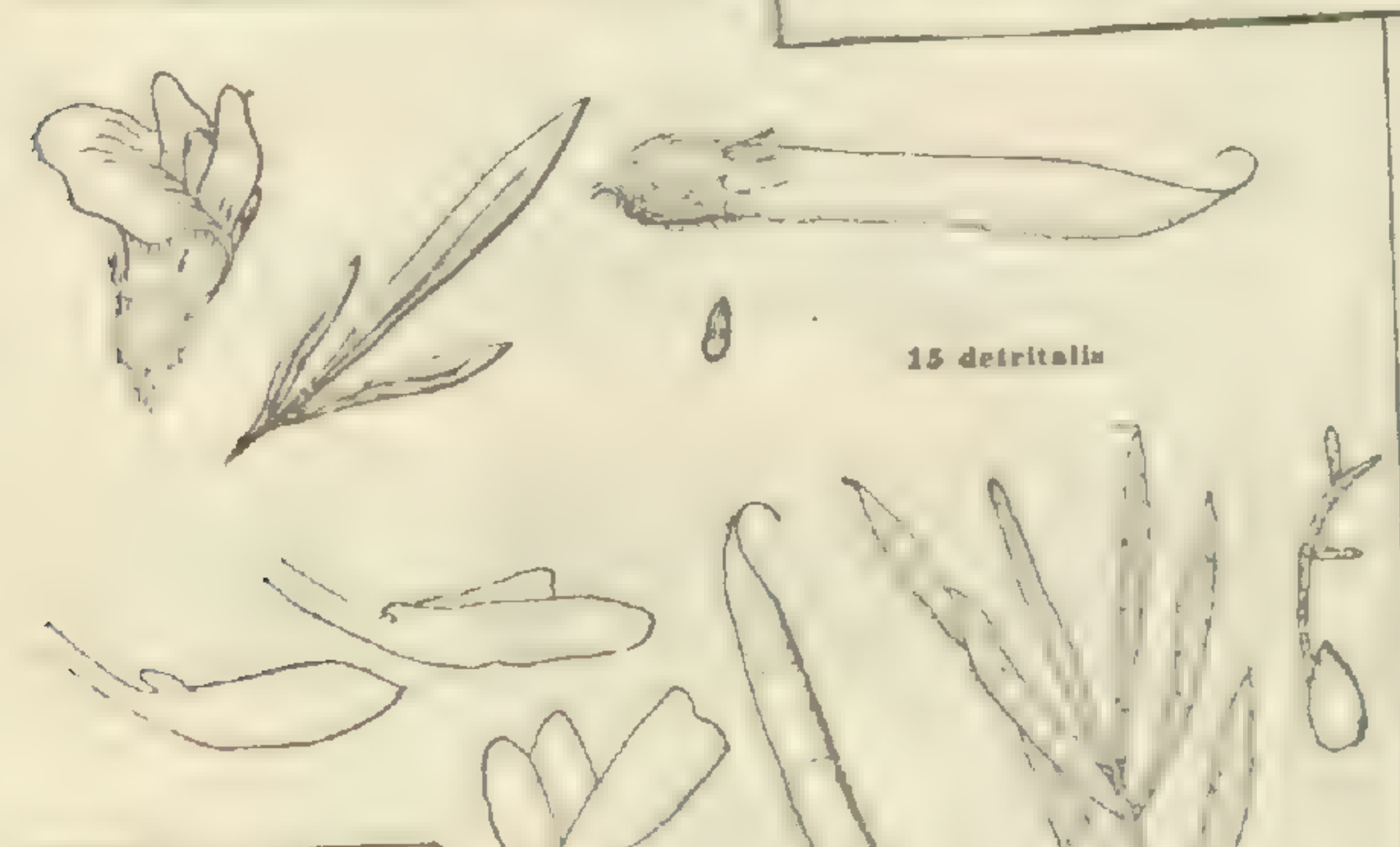
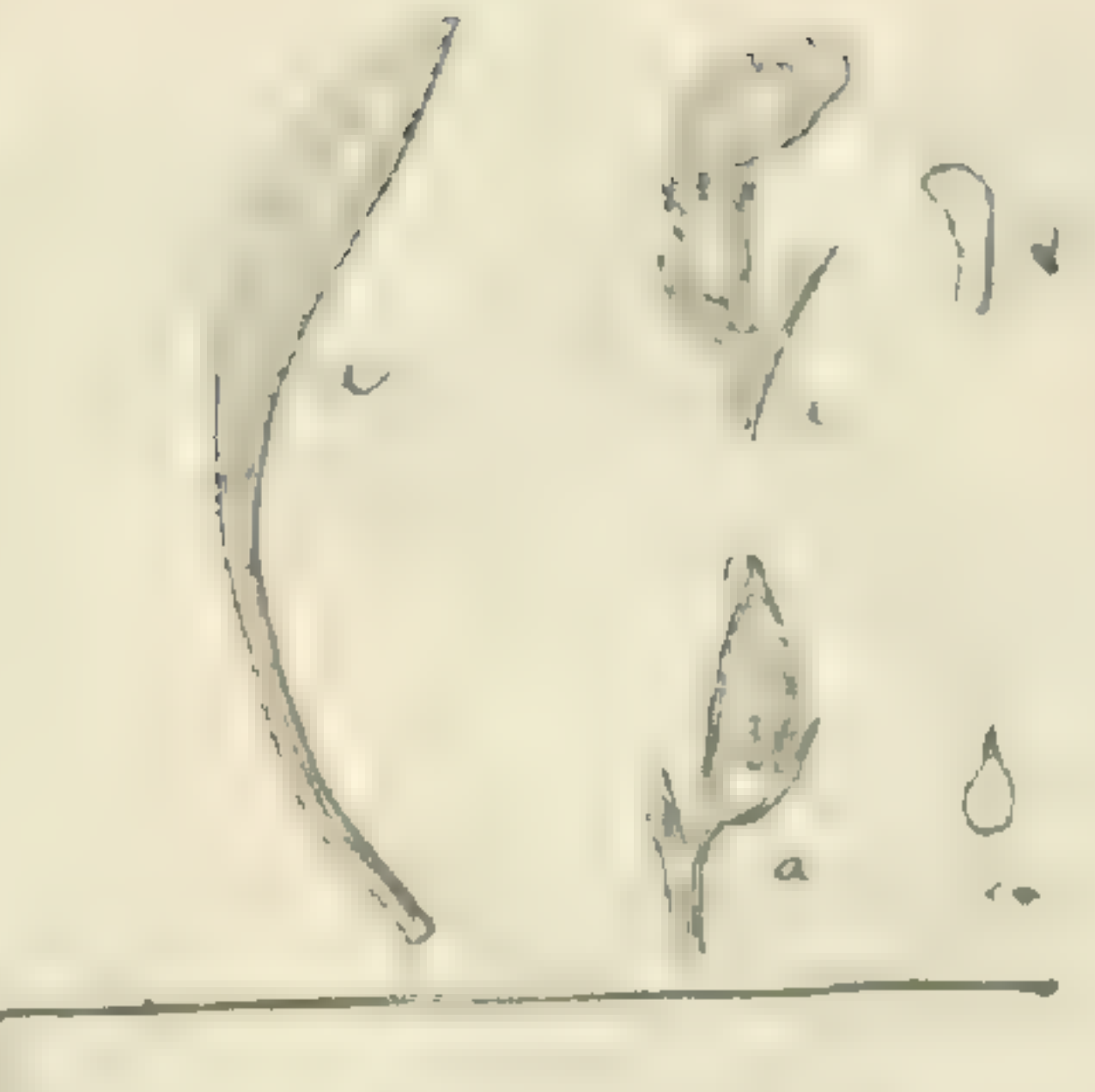
(4)



A. latocarpus

A. Epilacopus

Wiederb.





17 *humistratus*



A. *humistratus* var. No. 6013



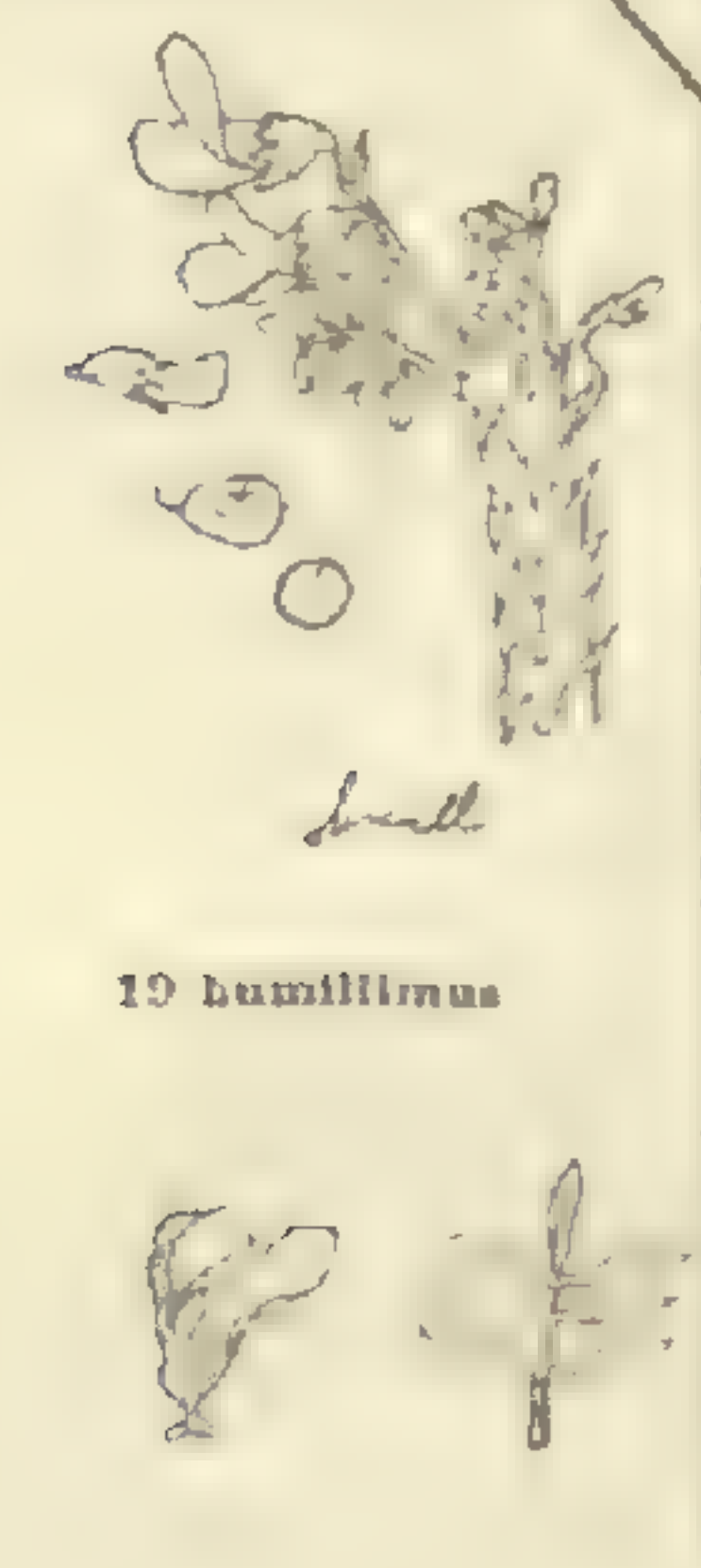
A. *humistratus* var. Hipsackia



A. *humistratus* var. *tenuiflorus*



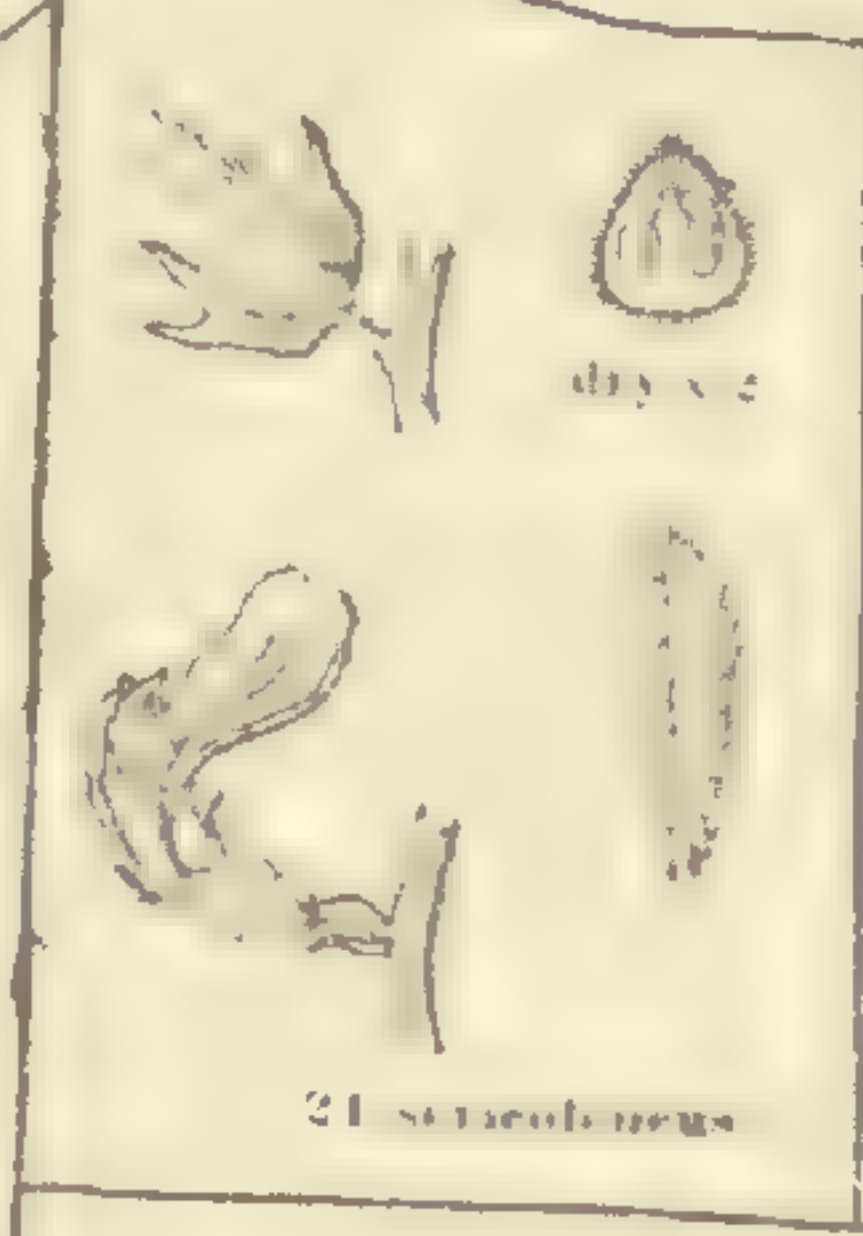
18 *sesquiflorus*



19 *humillimus*



20 *Gillenow*



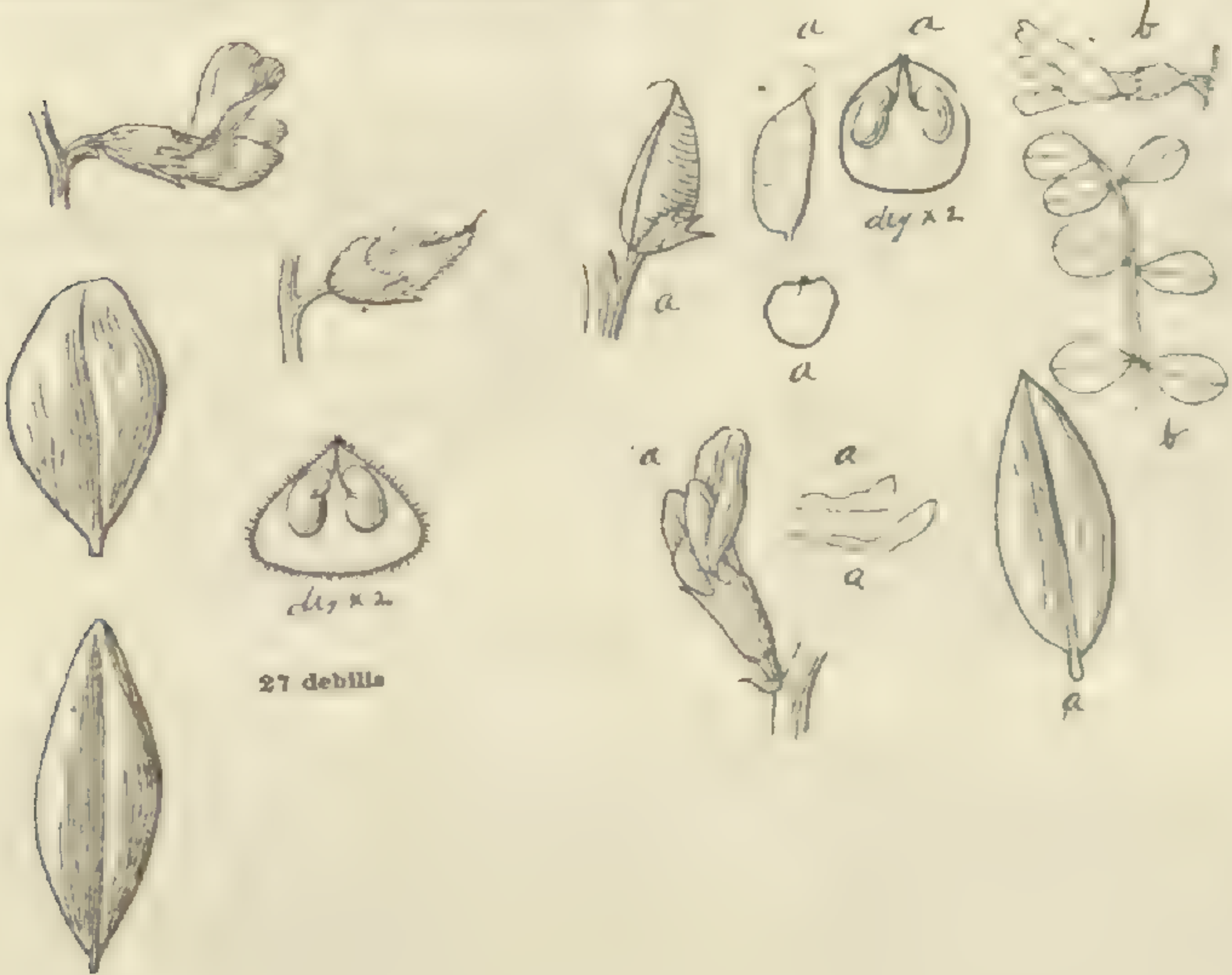
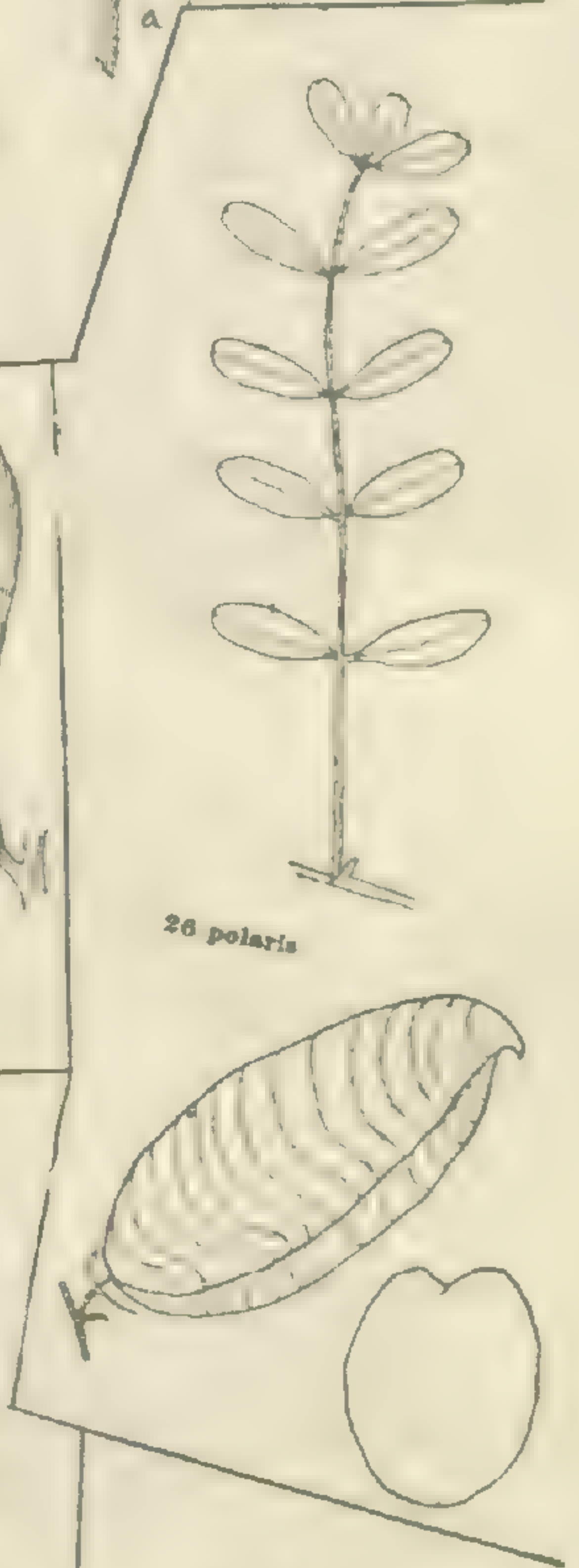
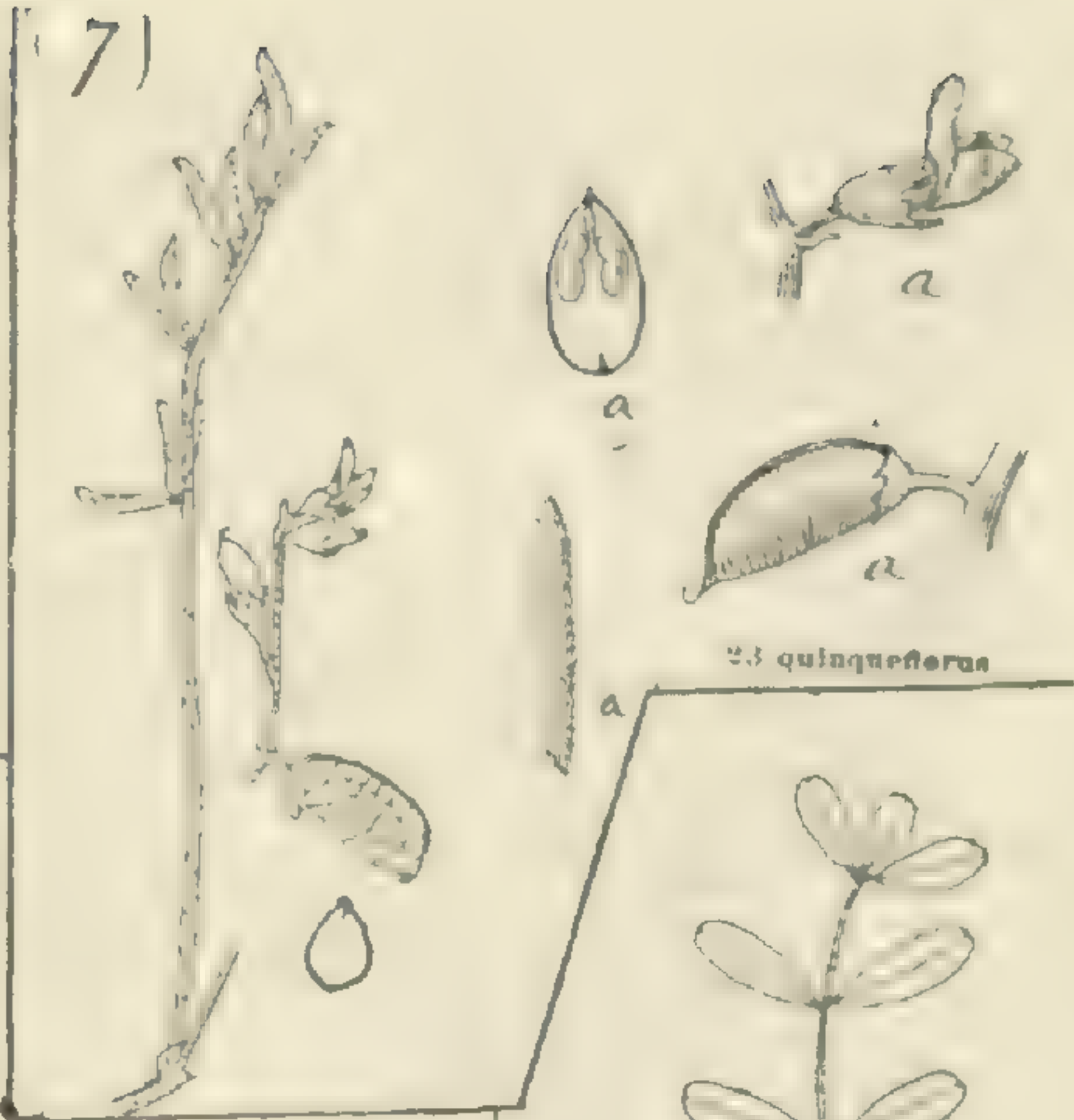
21 *sericeolens*

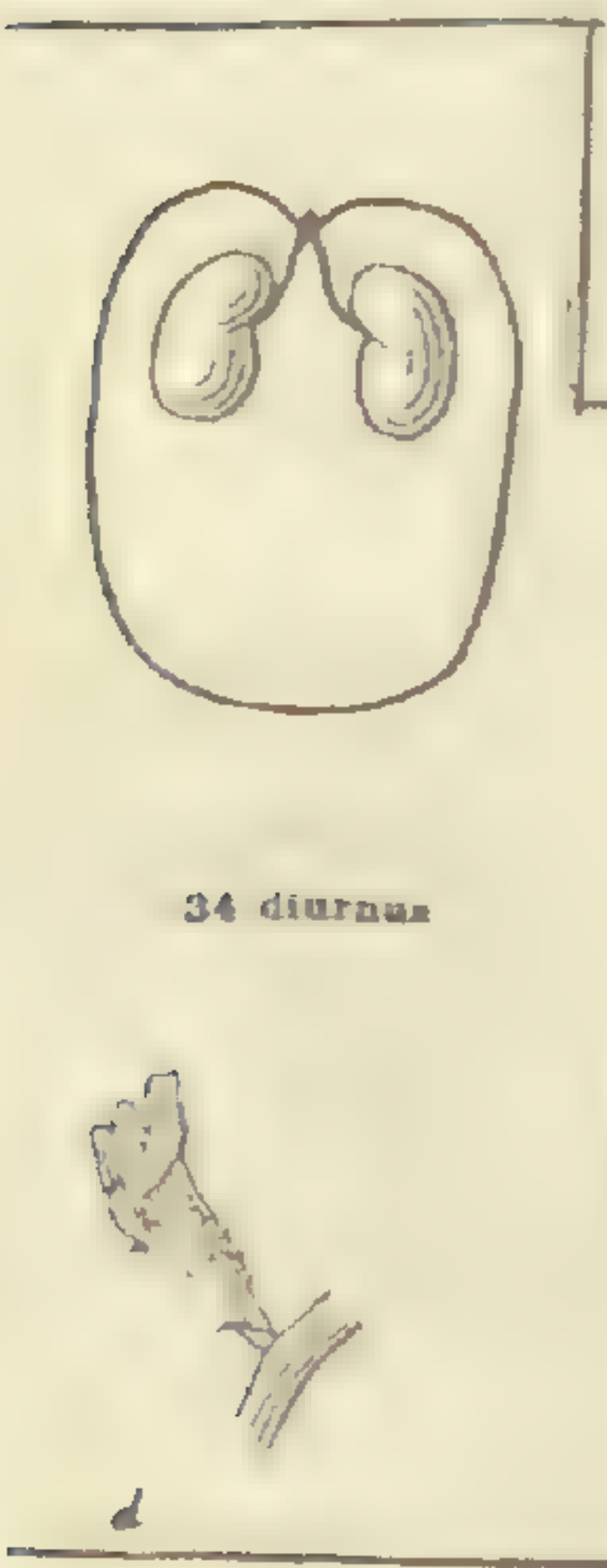
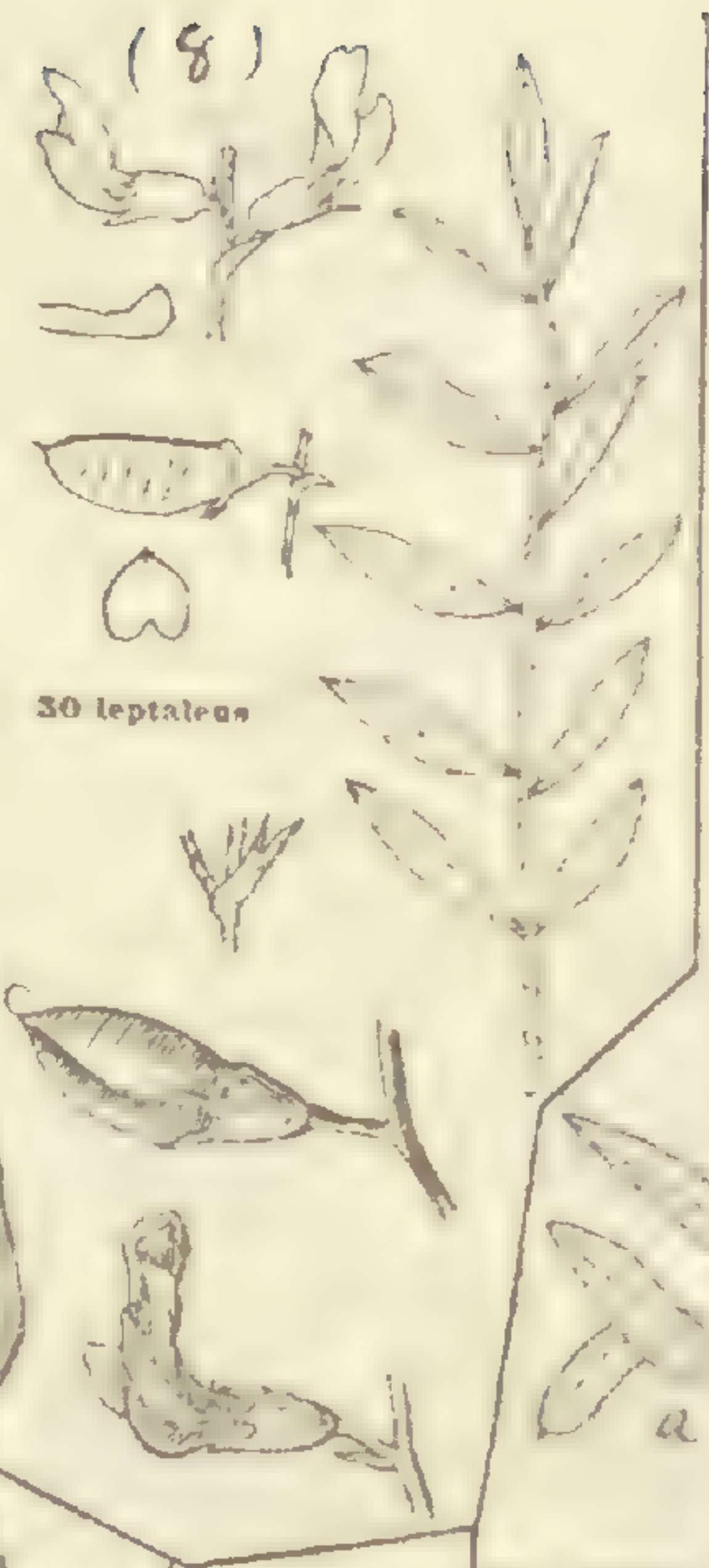
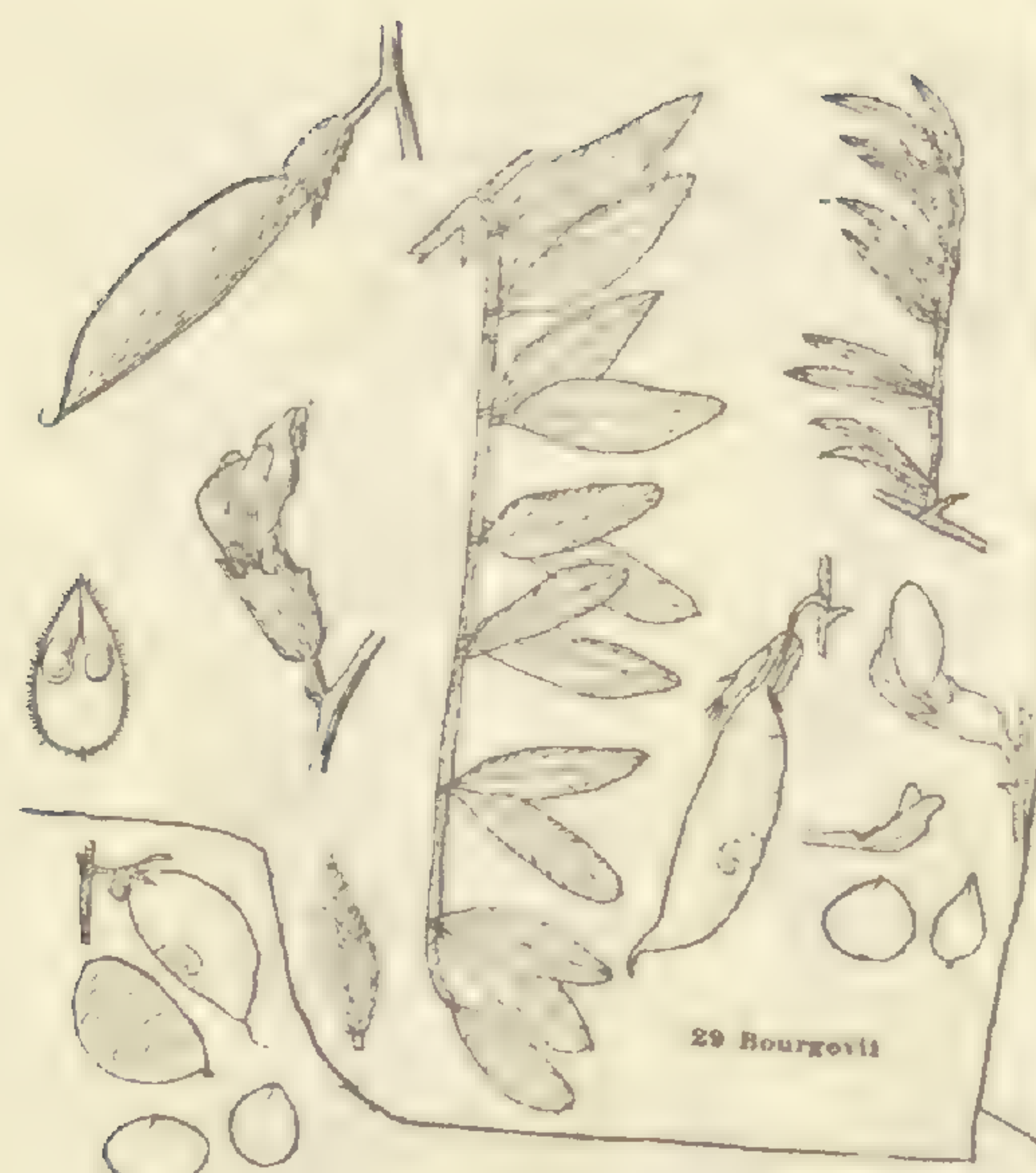


A. *sericeolens* var. *tetradymus*



A. *sericeolens* var. *Lindleyanus*



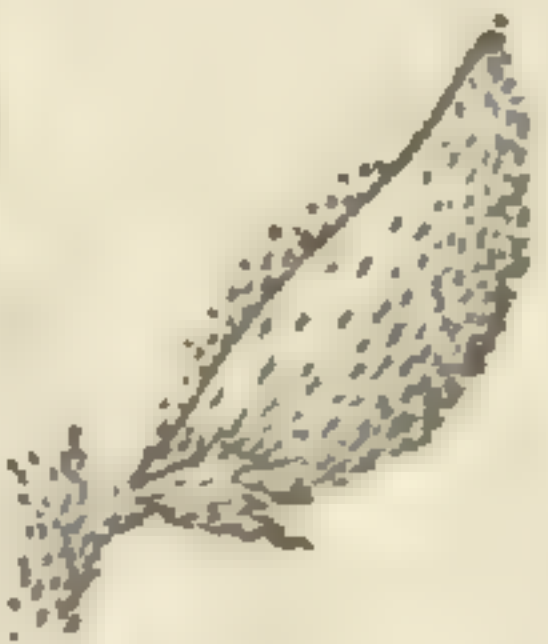
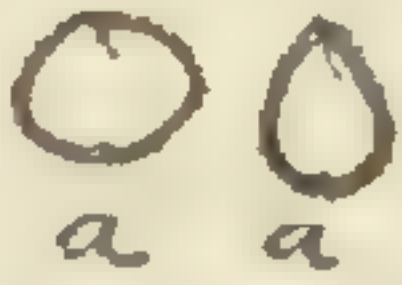


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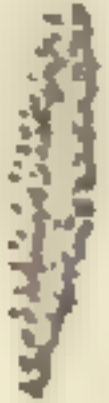
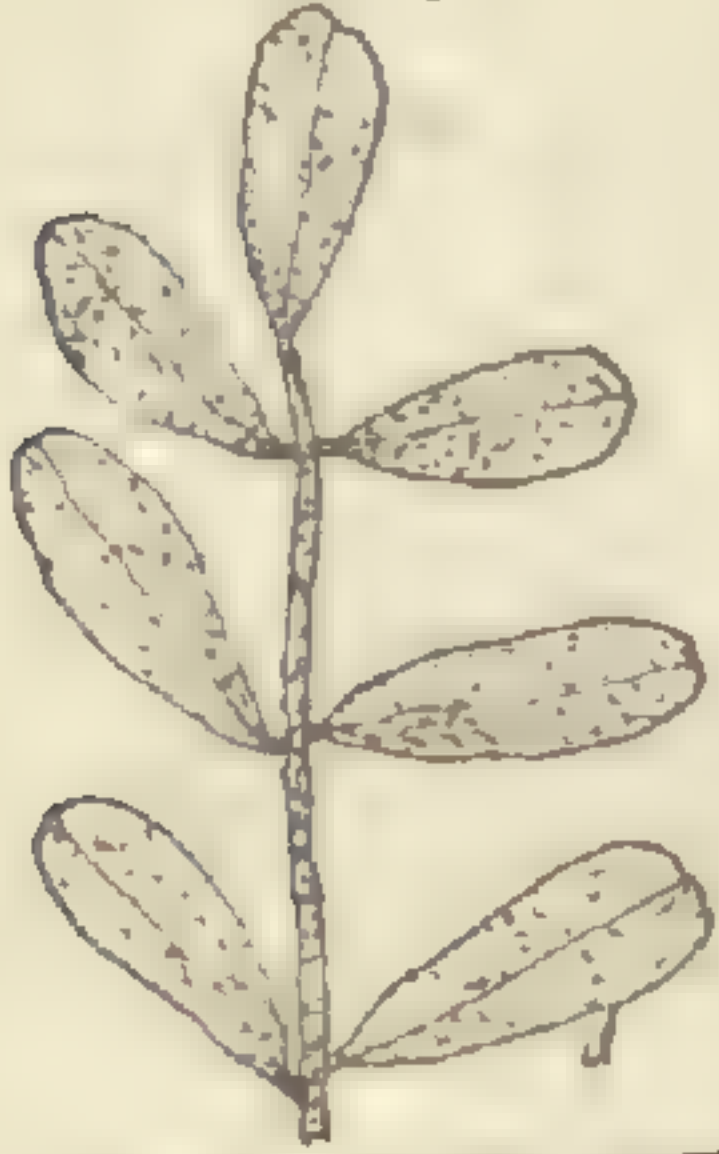
salicinarum



36 *subulana*



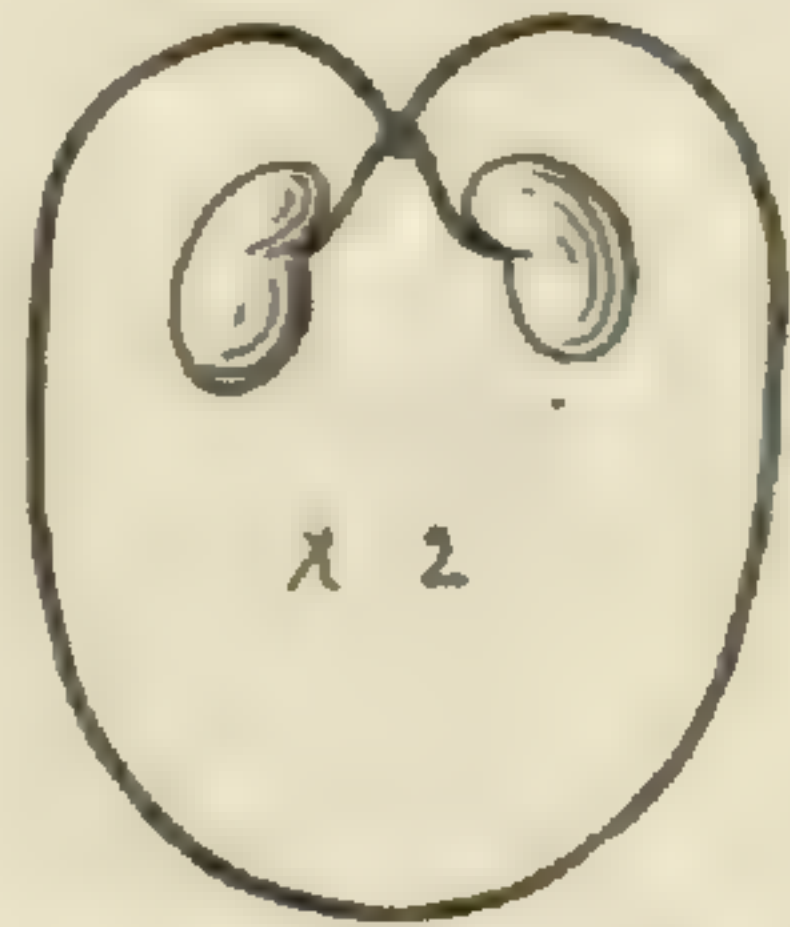
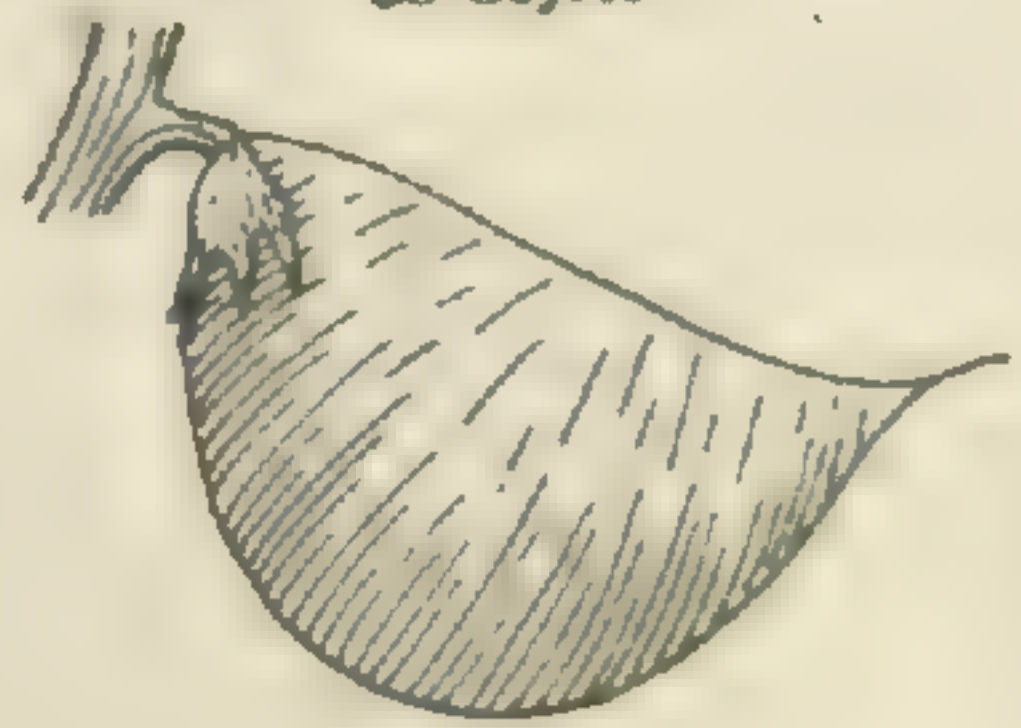
x 2



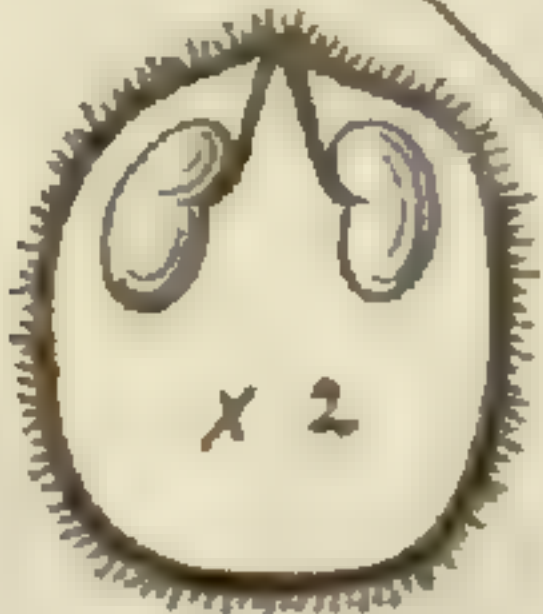
37 *aridus*



38 *Geyeri*



x 2



39 *Julliana*



x 2

40 *prolifera*



x 2

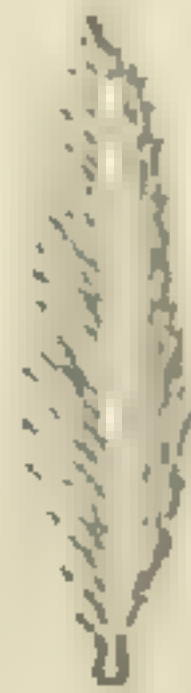


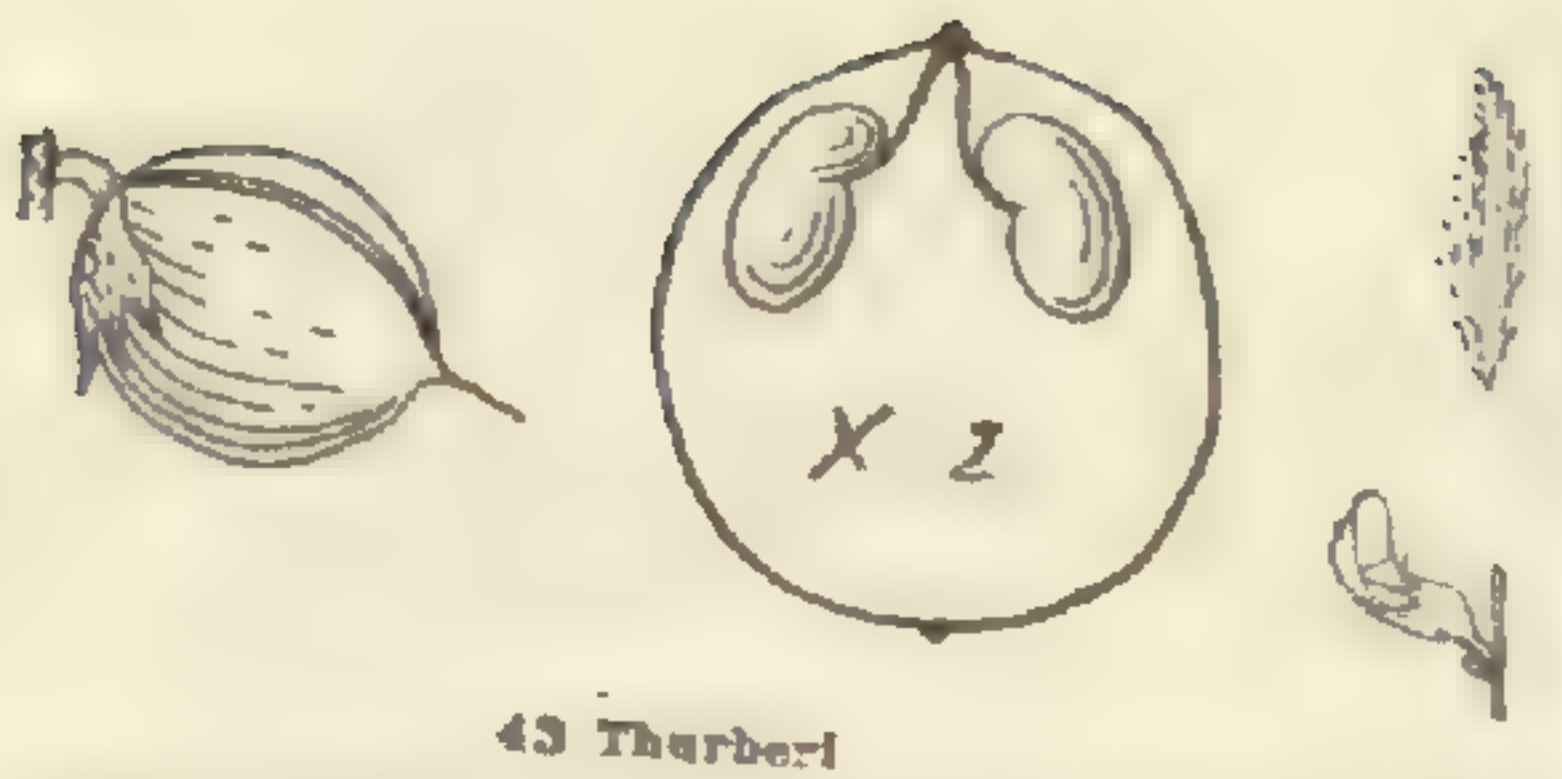
x 2

41 *melanus*



42 *Vaseyi*





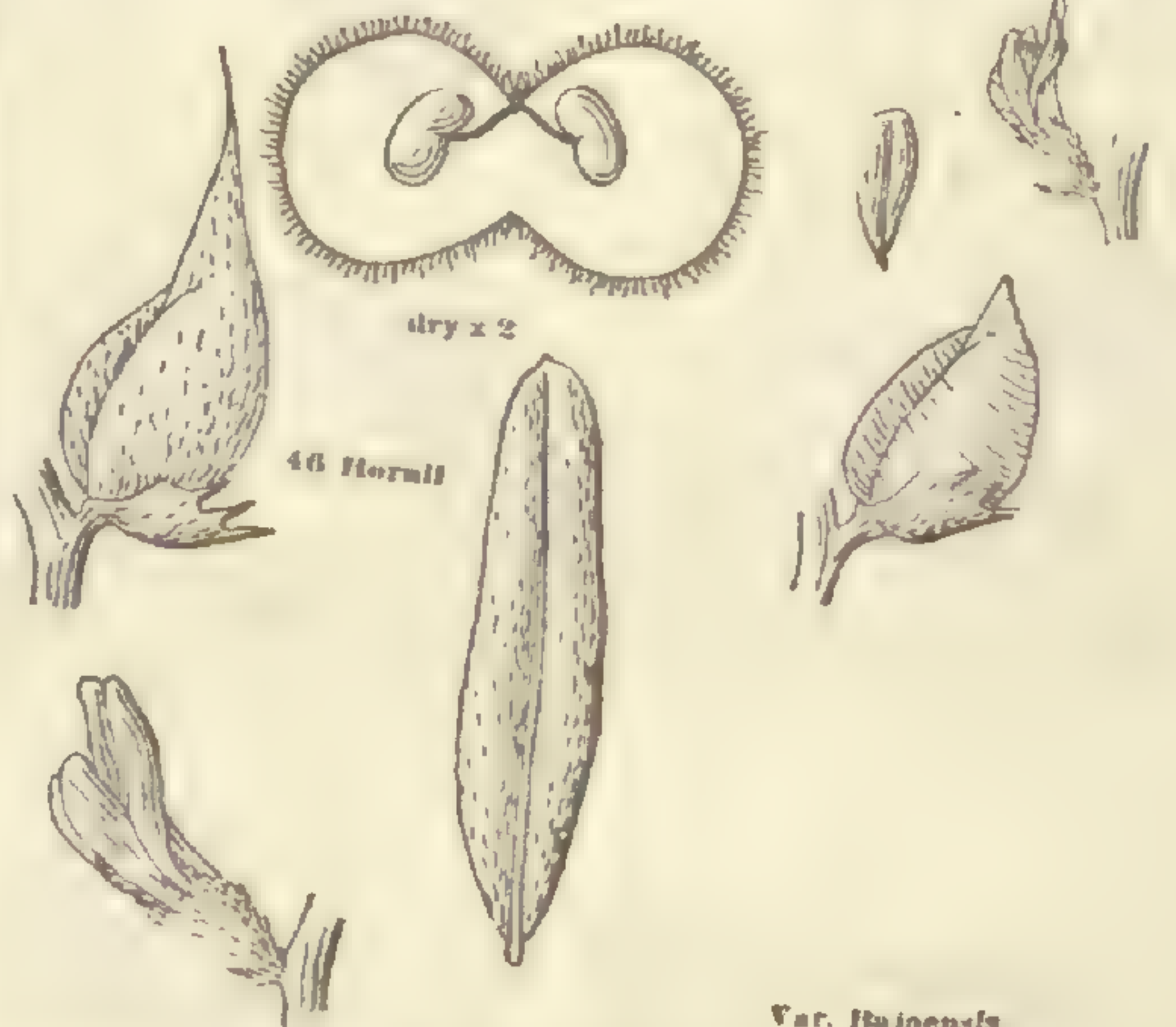
43 Thurberi



44 Palmeri

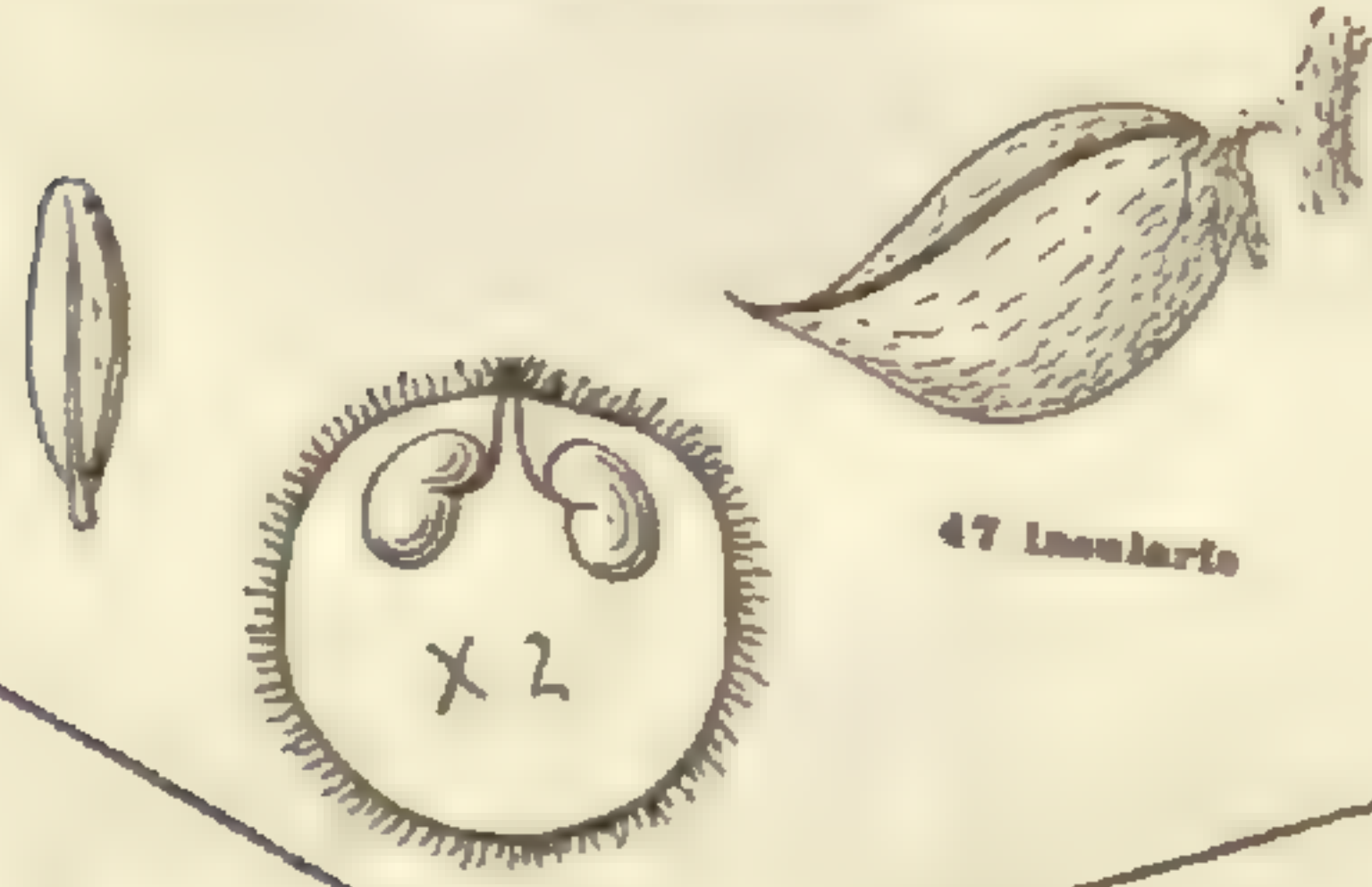


45 pycnostachyum

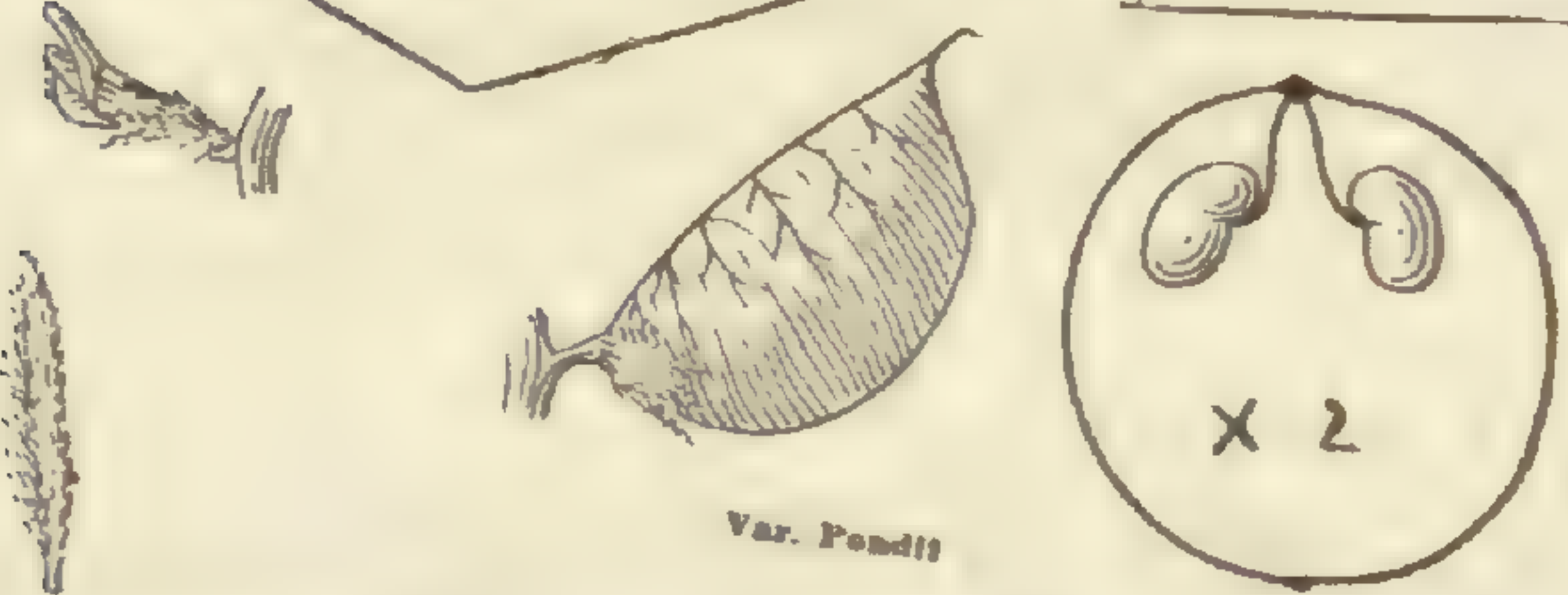


46 Hornii

Var. Itajensis



47 Inularis



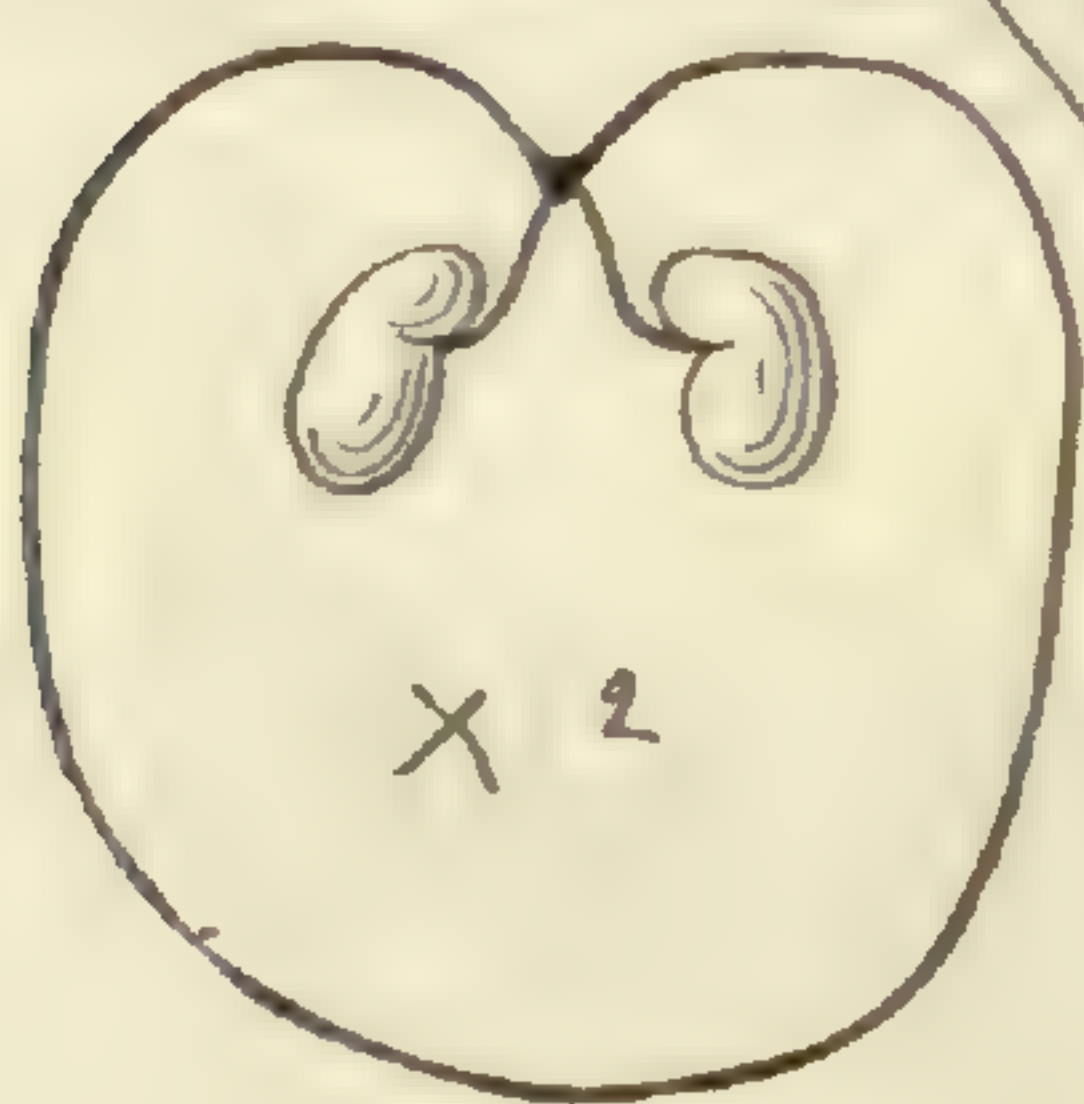
Var. Pondii



48 triflorus

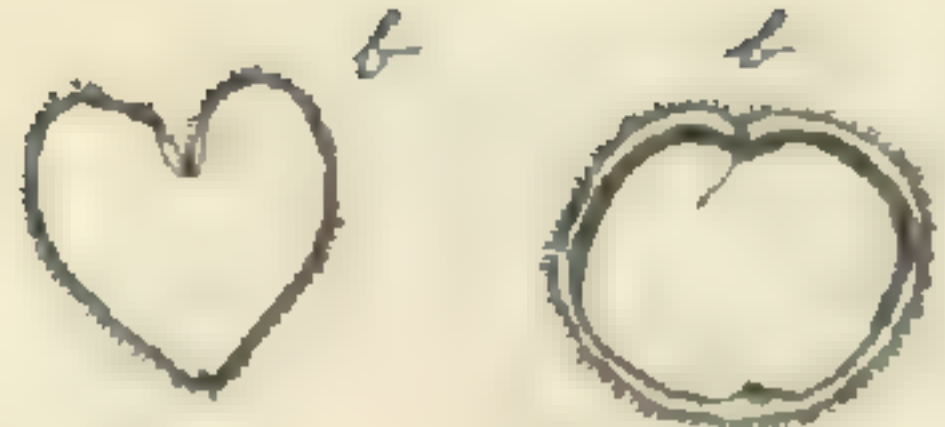


Var. Quatinus



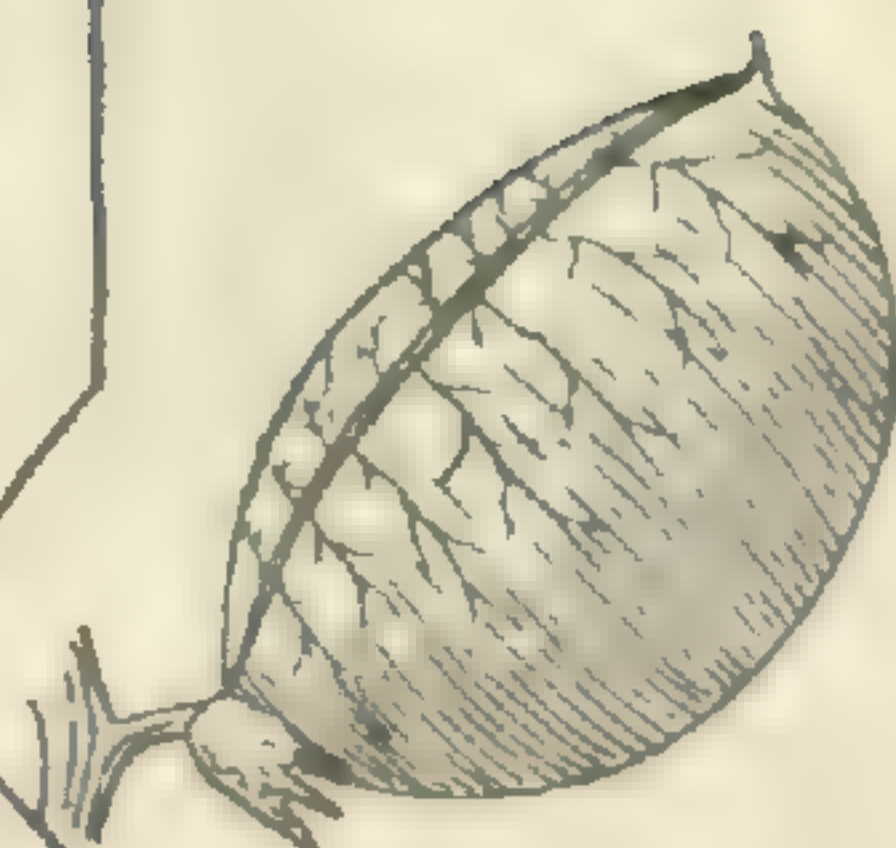
48 triflorus

(11)

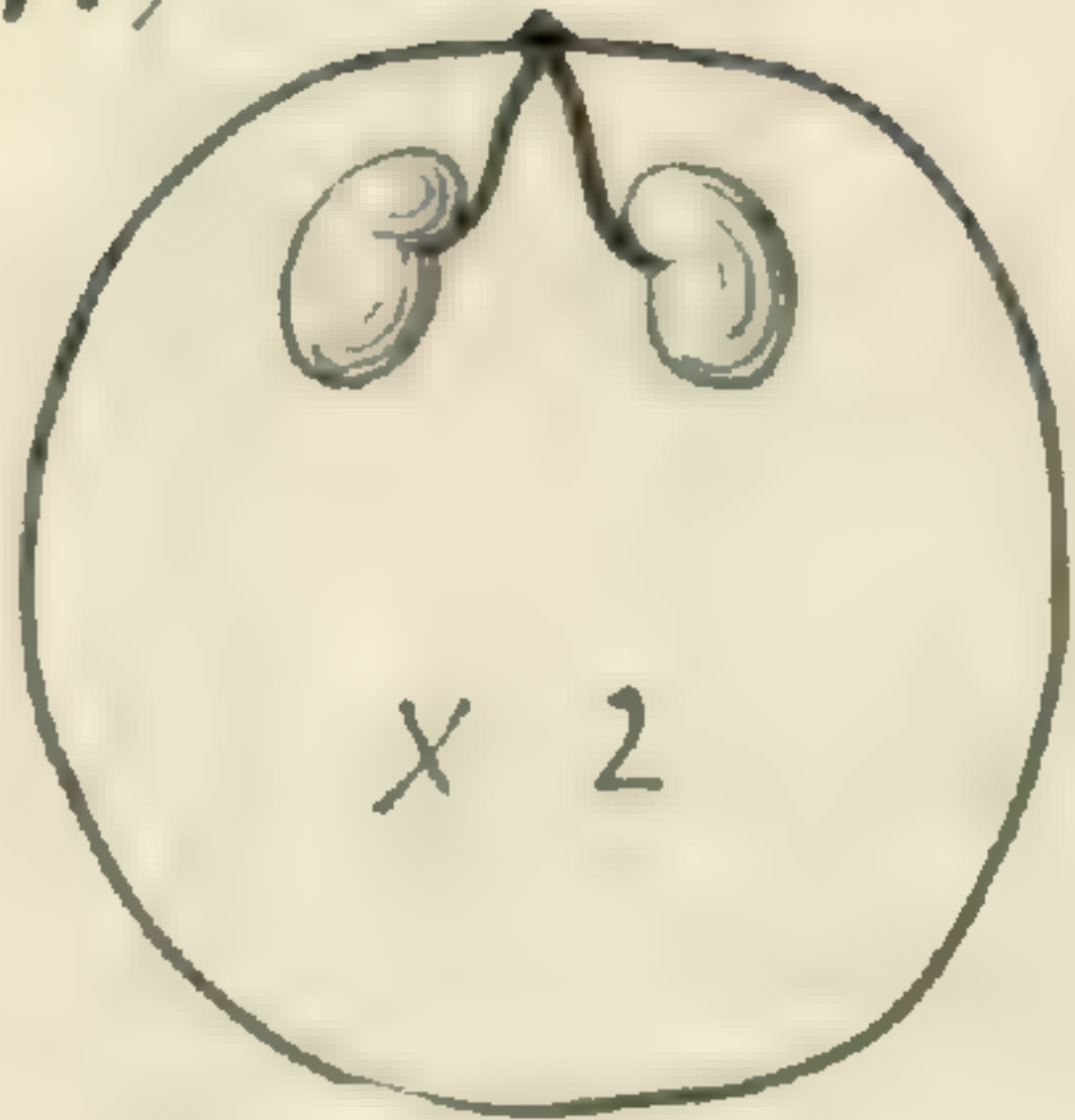


San Pet
huglum

Var. cerussatus



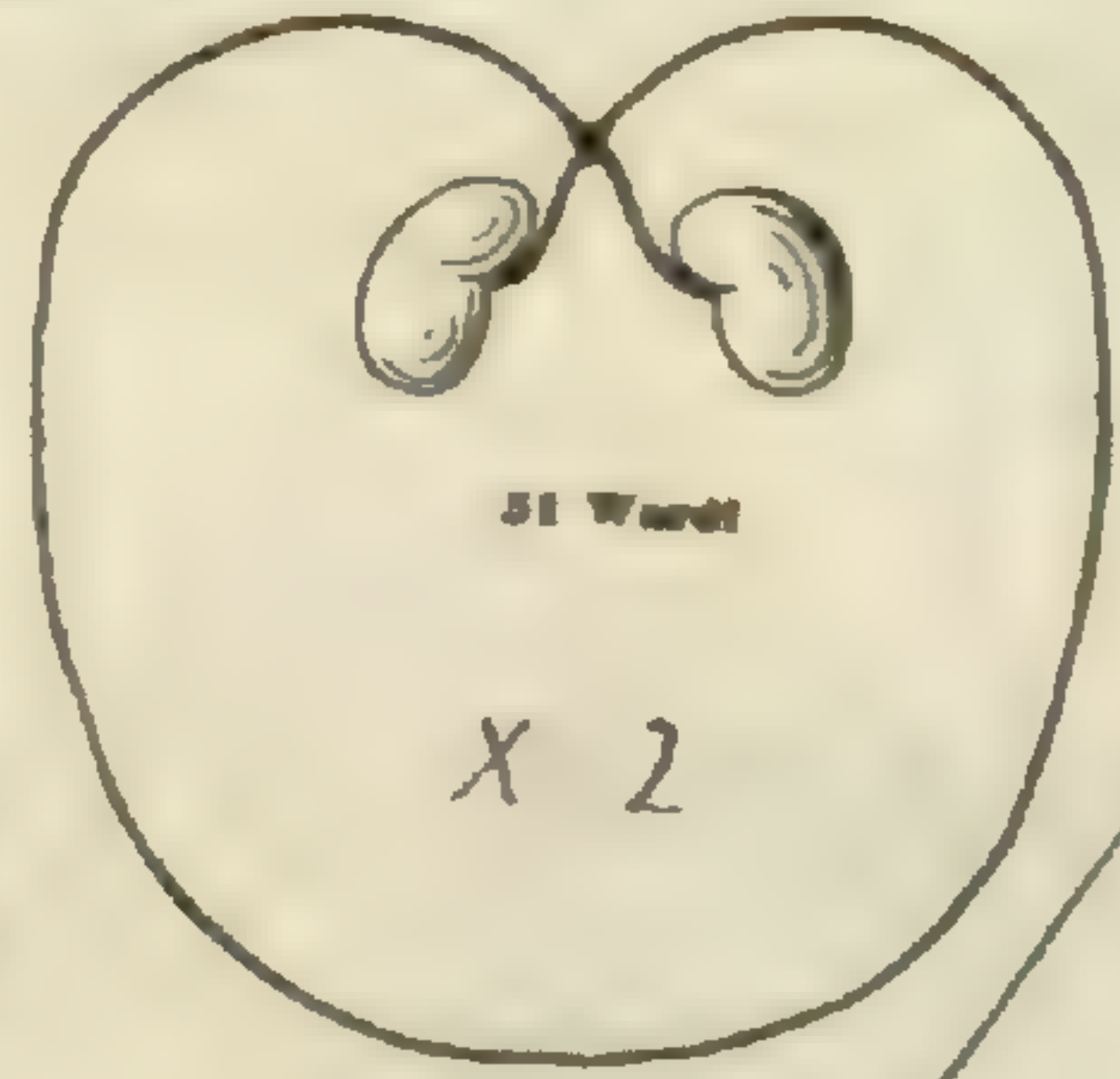
Var. playunas



49 submerum

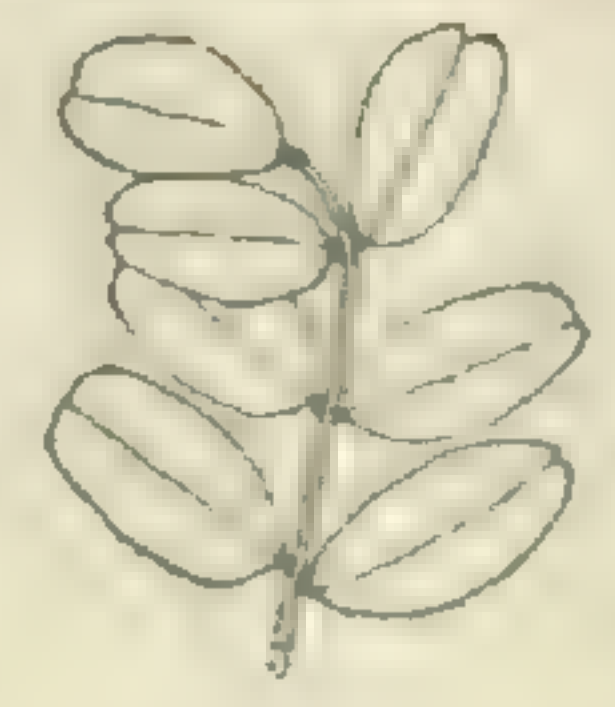


50 scalaris



51 Wardi

X 2



Var. quercotinus



53 serpens



83 nutans

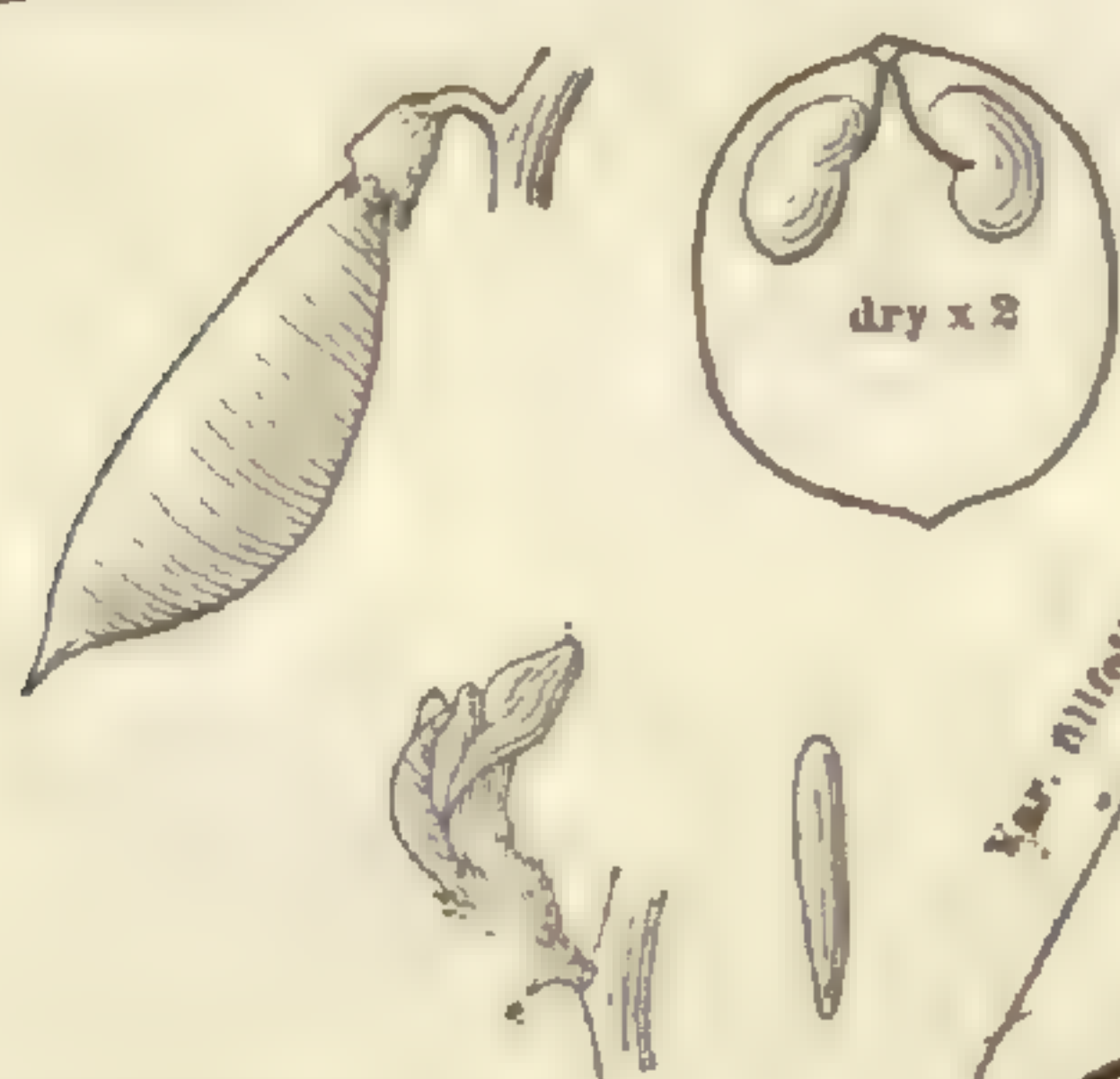


84 picta

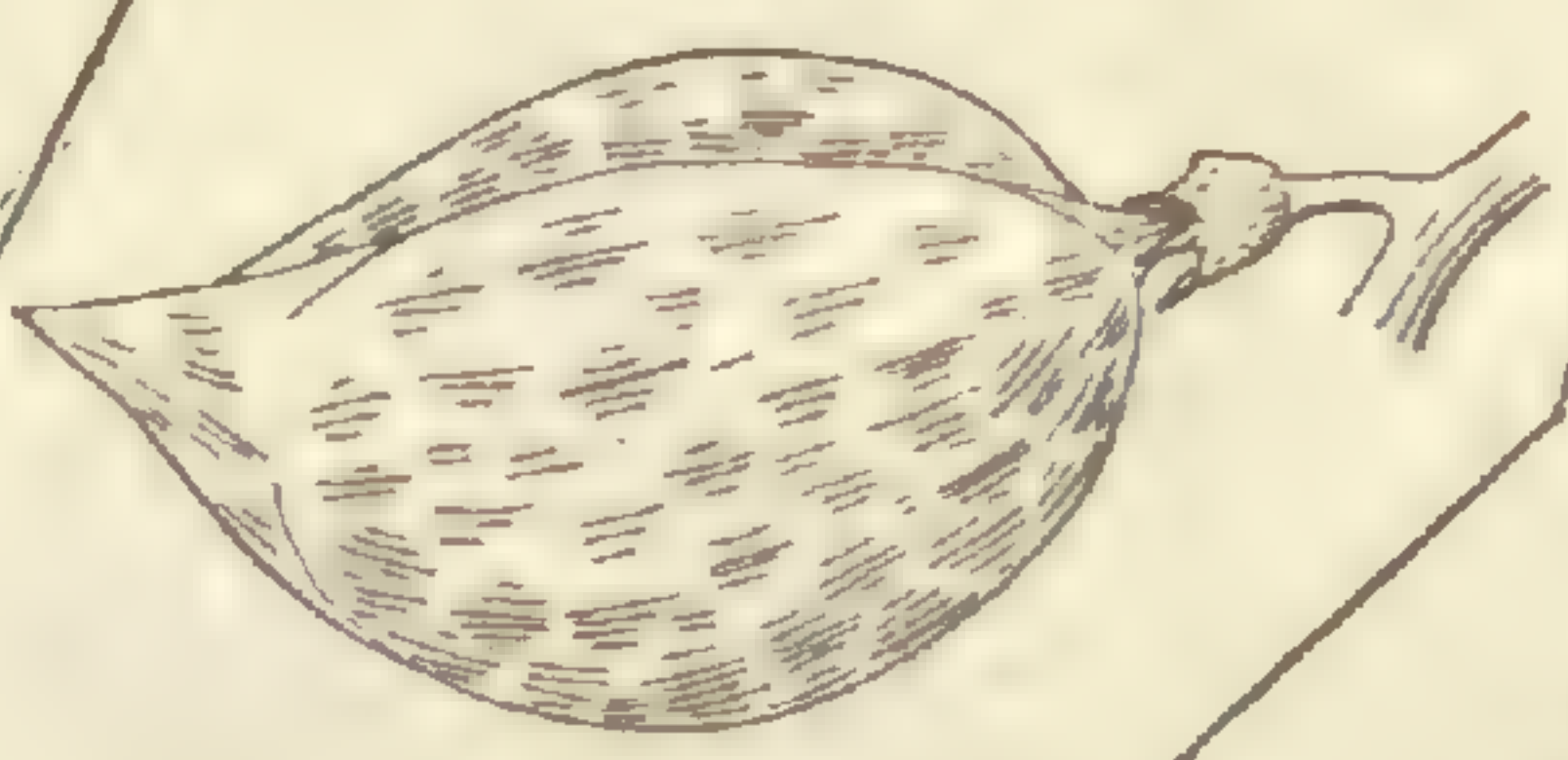


dry x 2

Var. nitidula



dry x 2



85 vestita

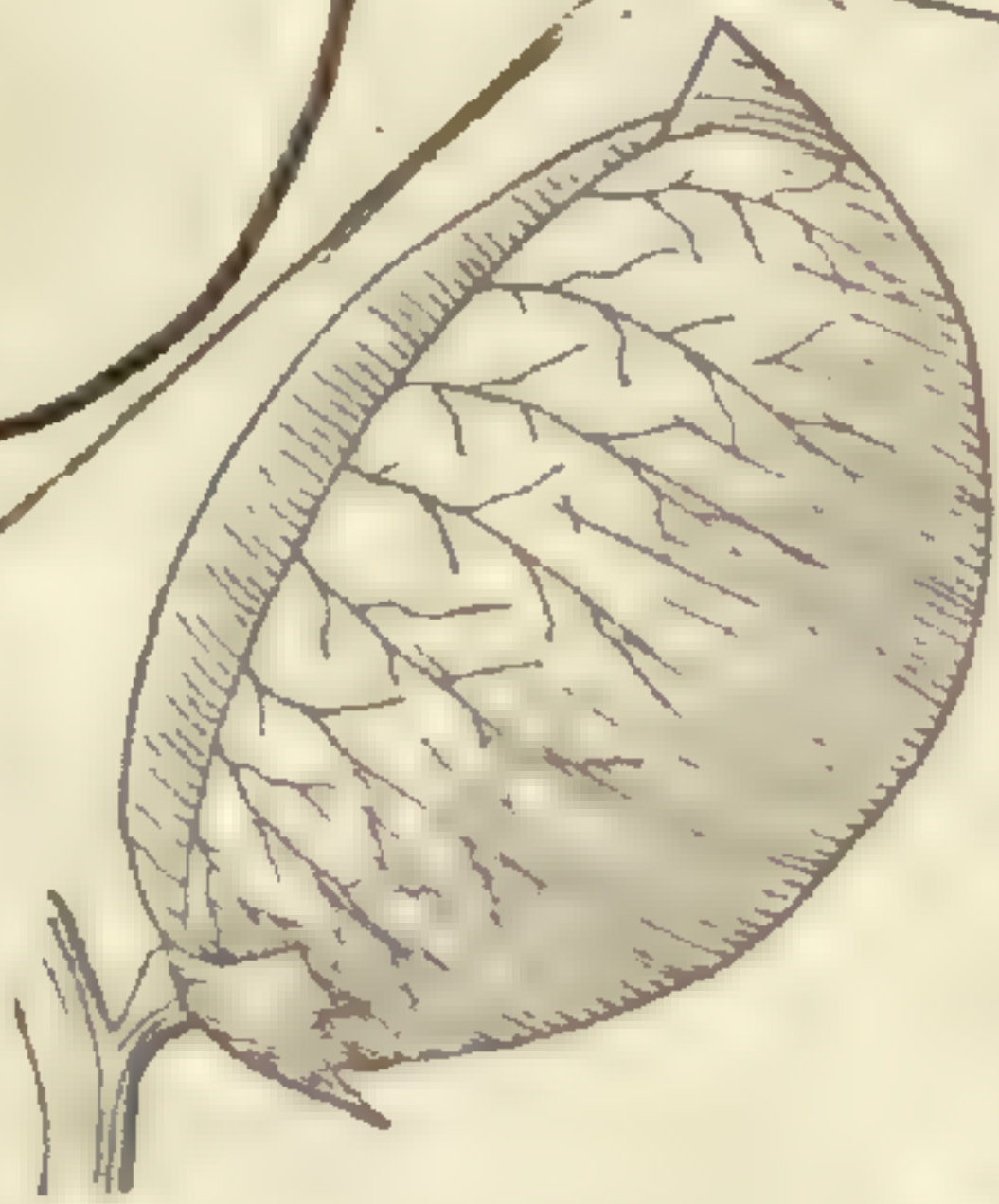
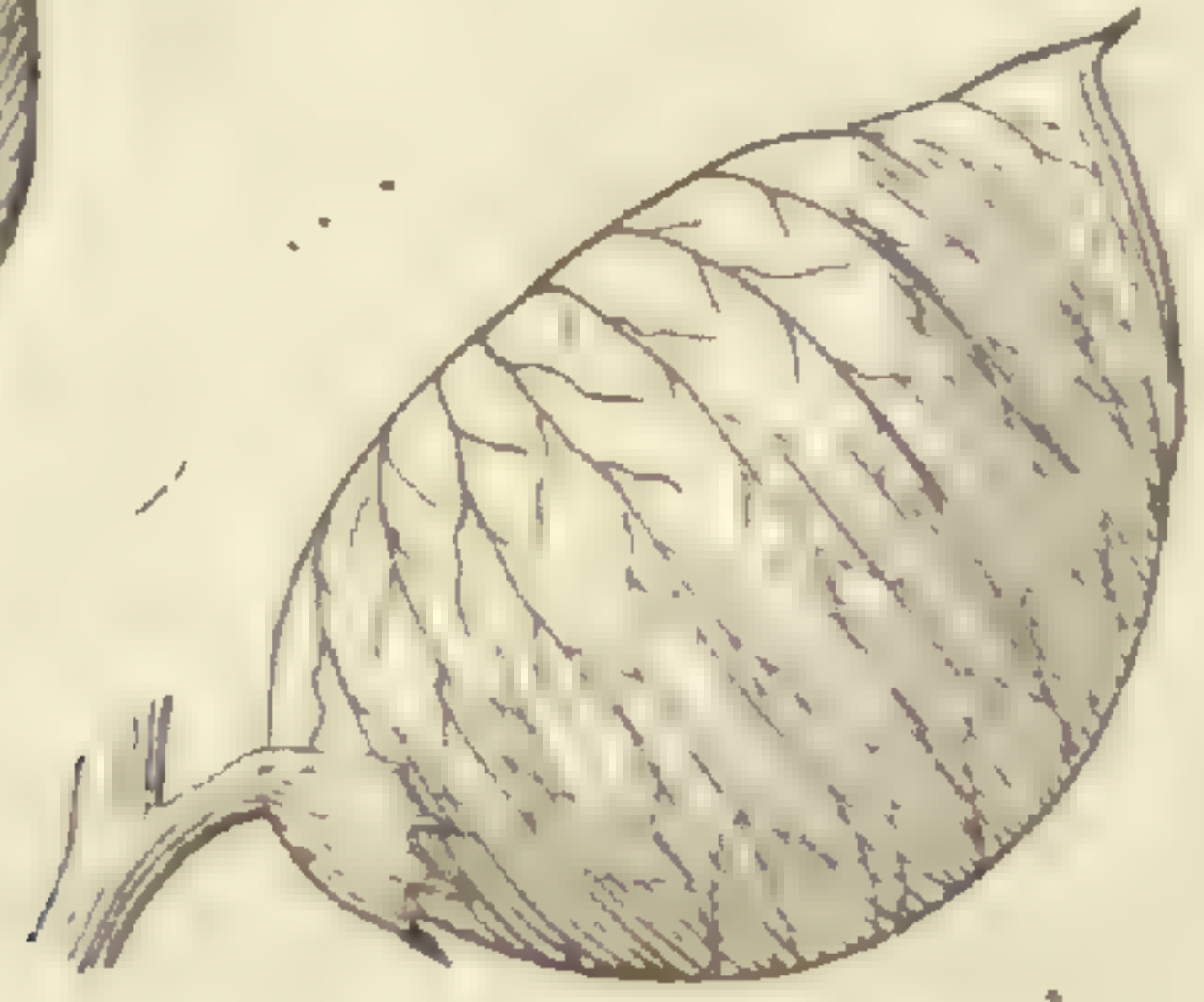


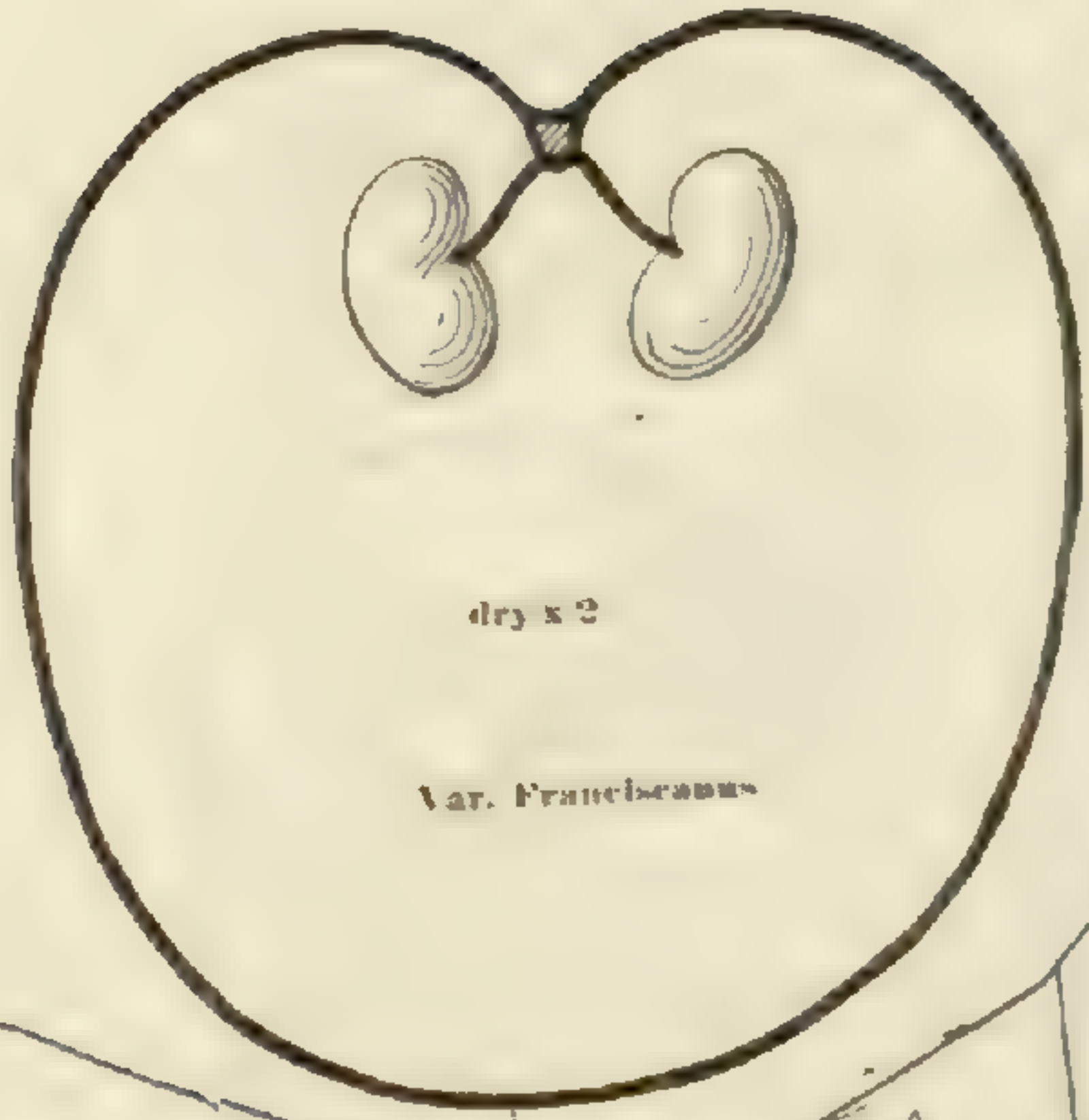
Var. magnum



dry x 2

Var. Menziesii



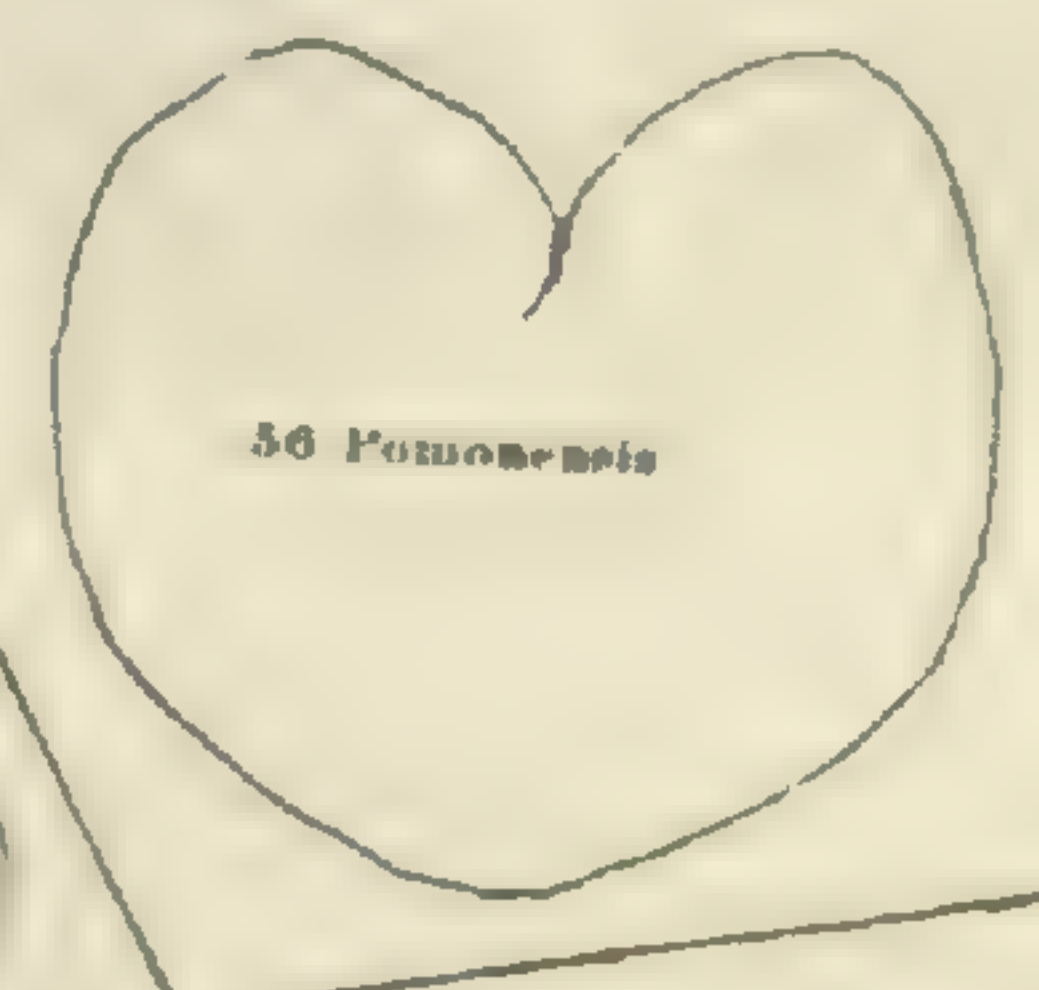
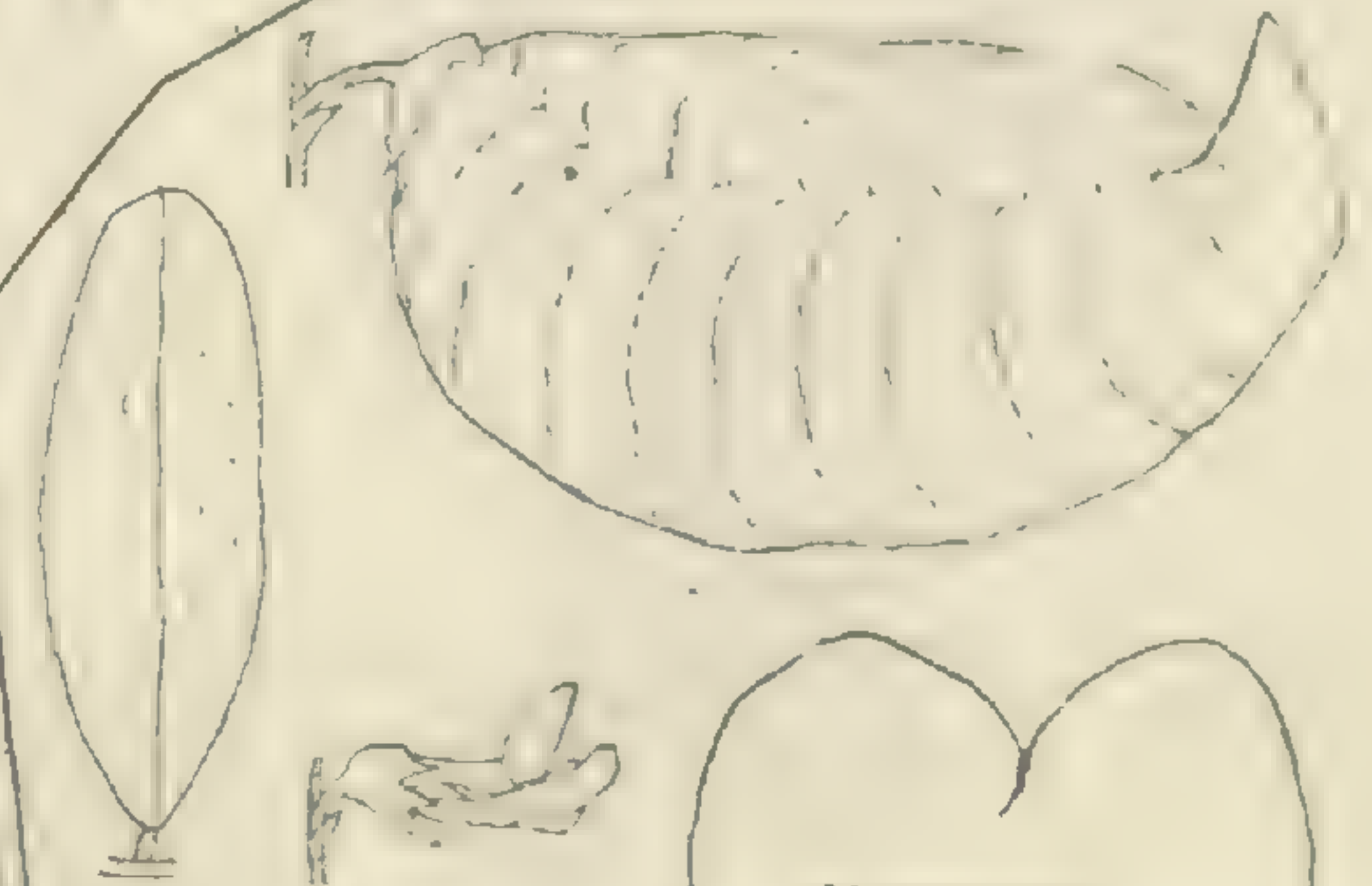


dry x 2

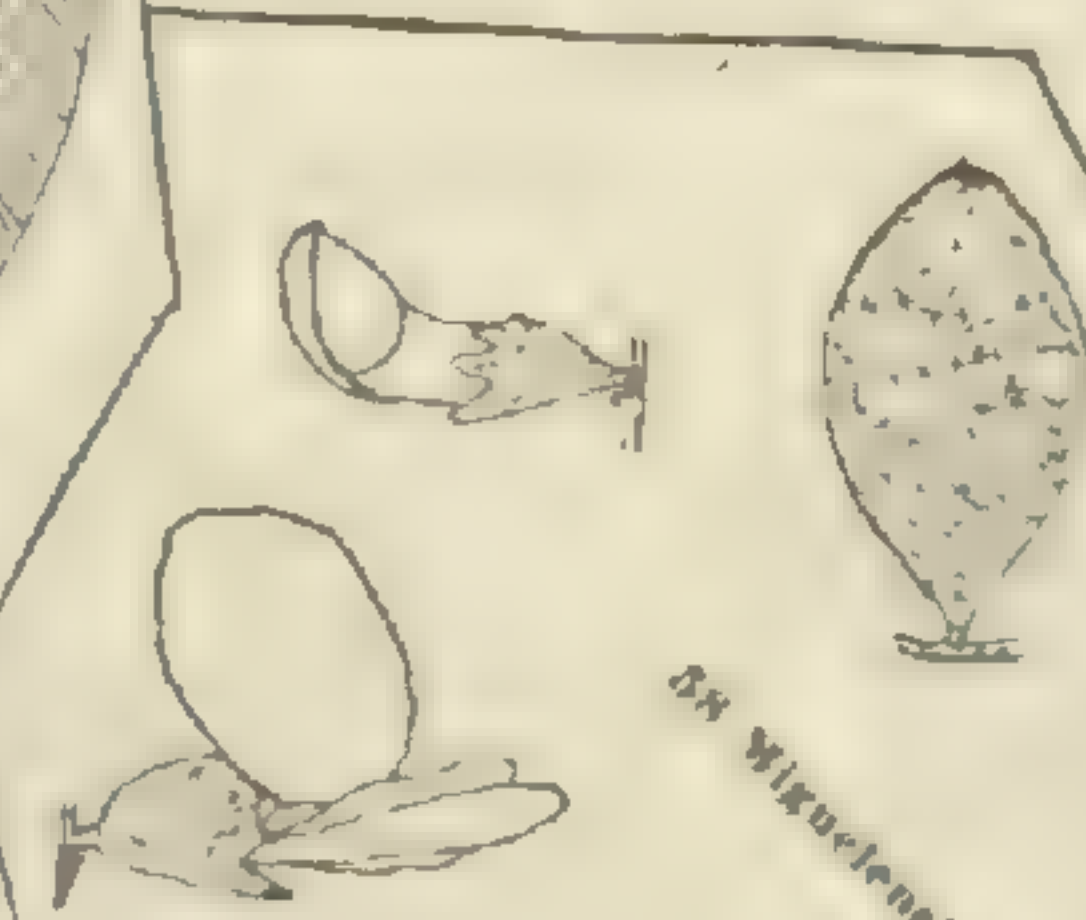
Var. franciscanus



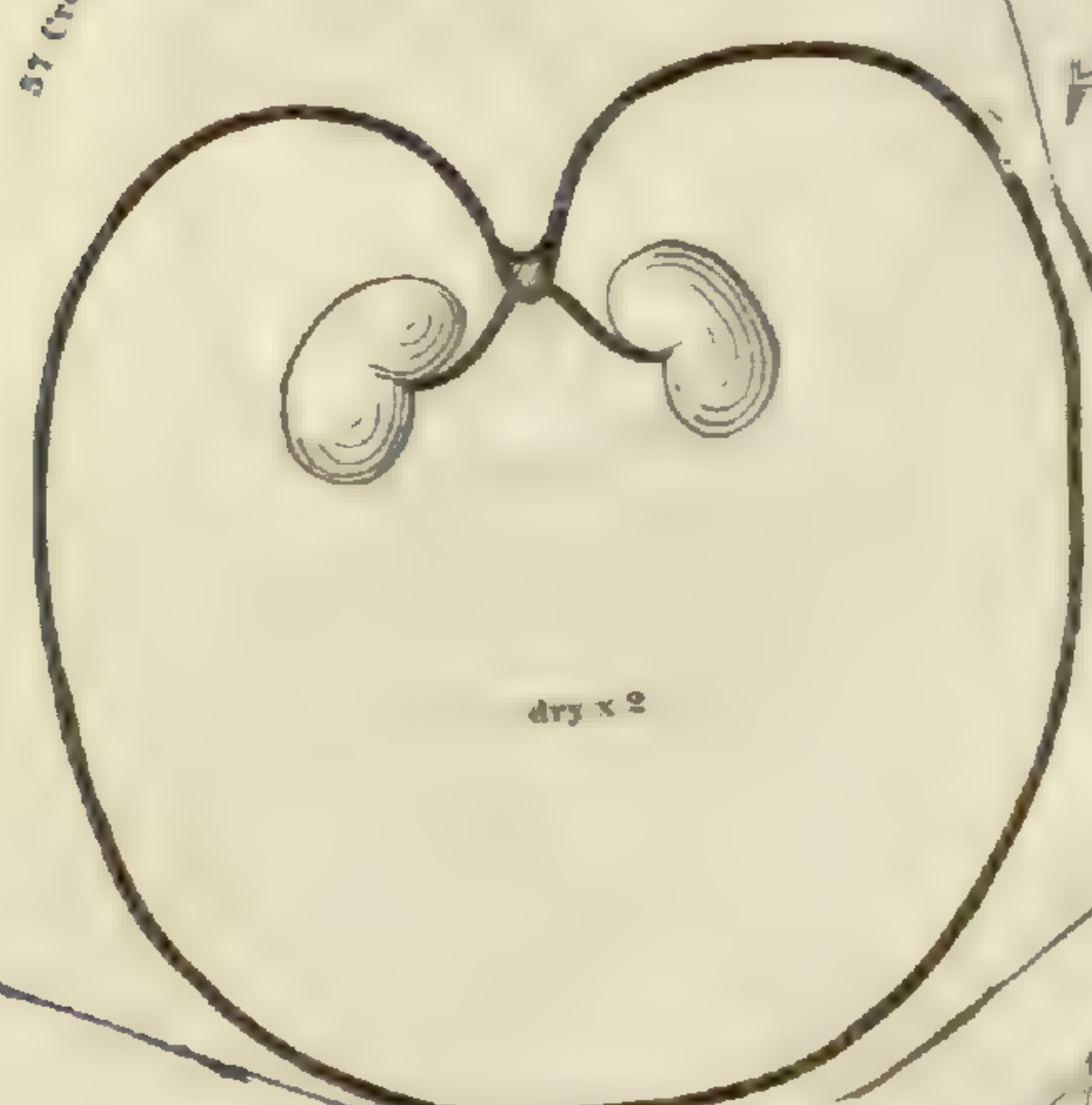
57 *Crotolaria*



56 *Pomonensis*



58 *Mexicana*



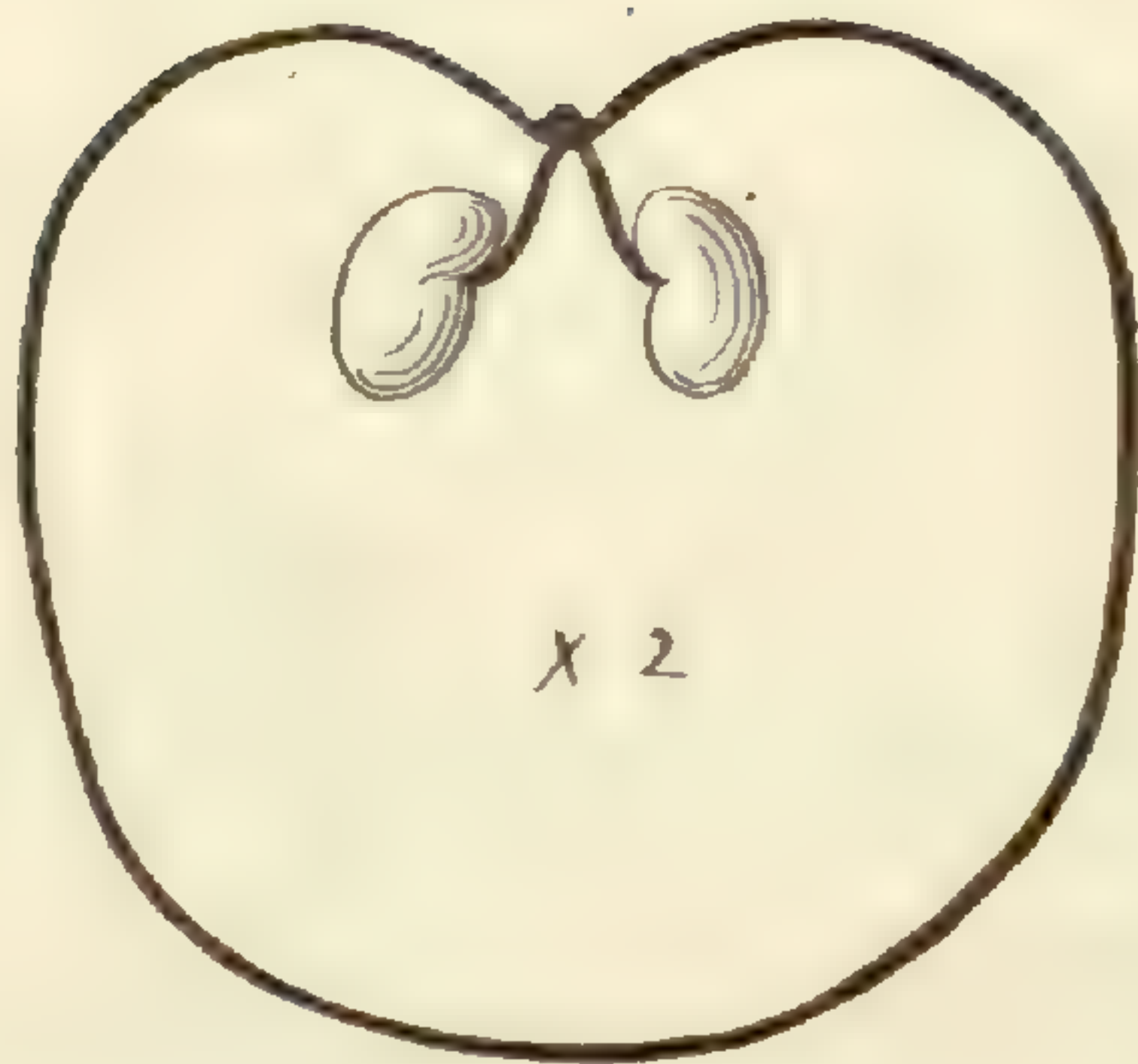
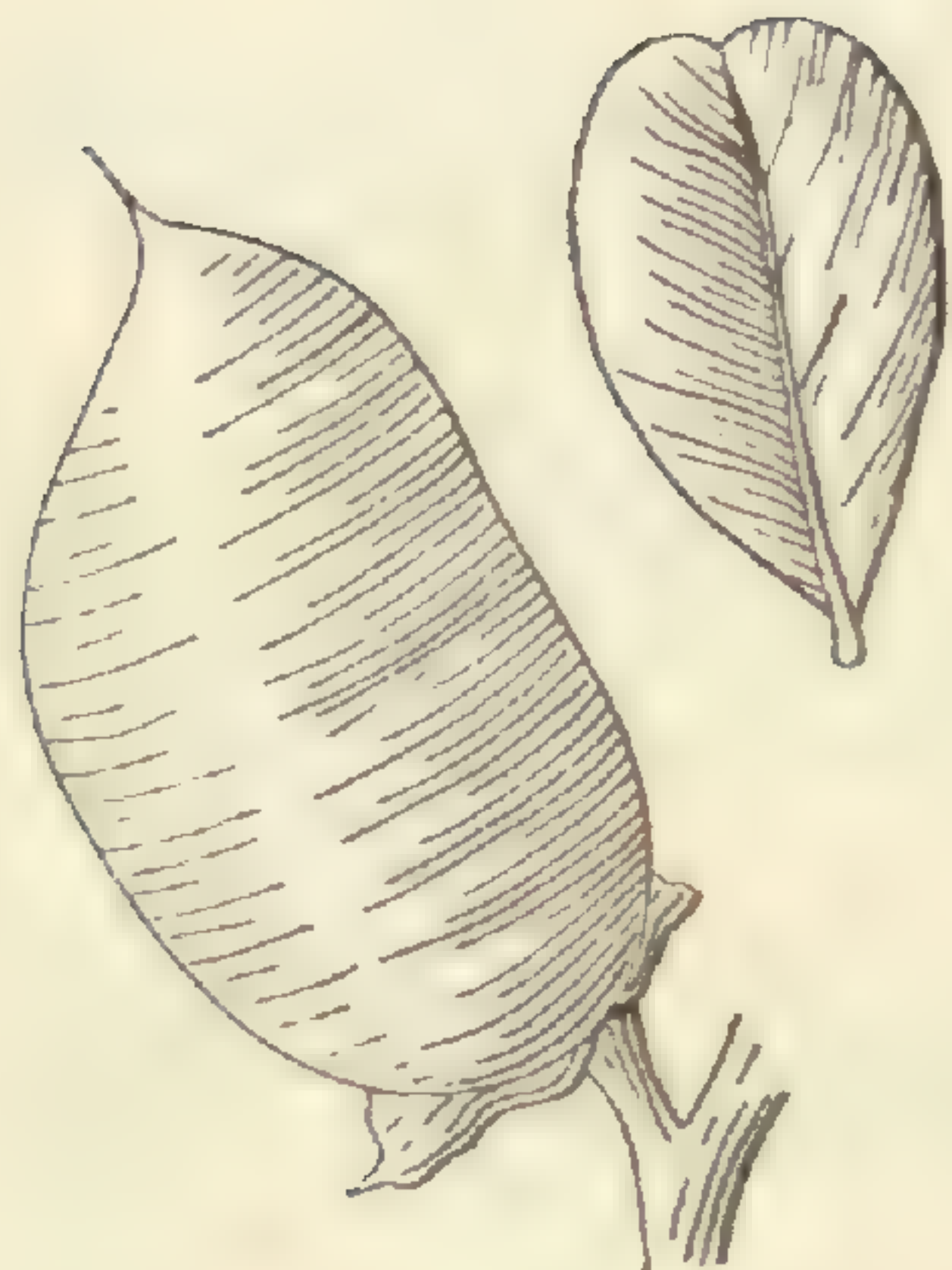
dry x 2



59 *Magdalena*

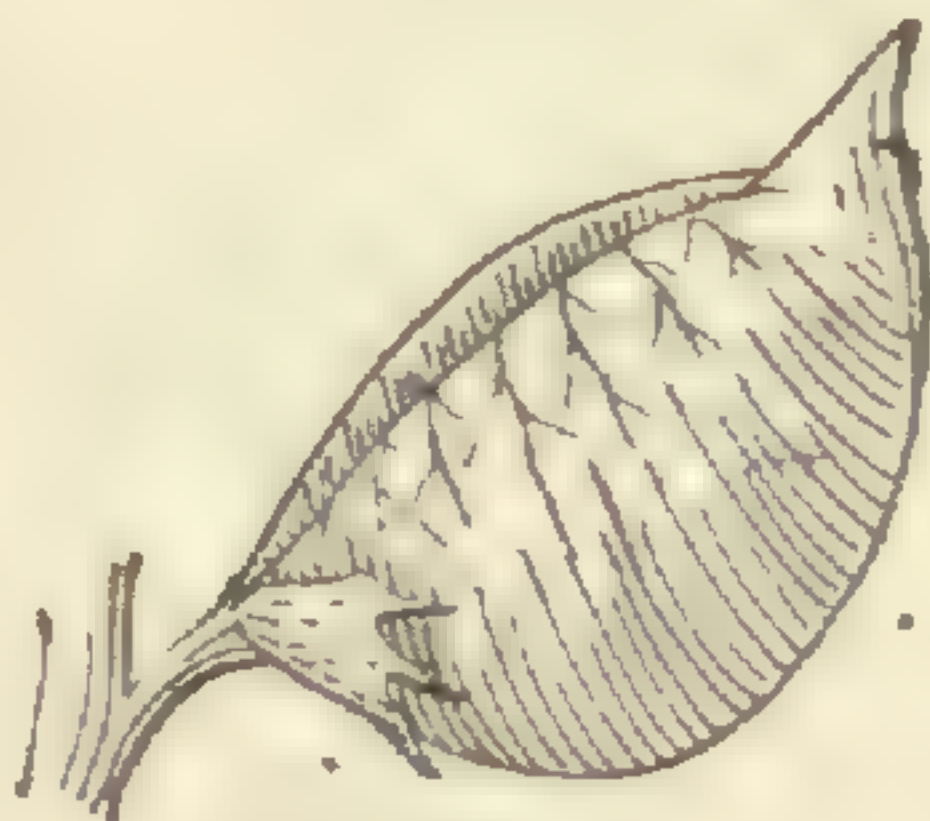


dry x 2

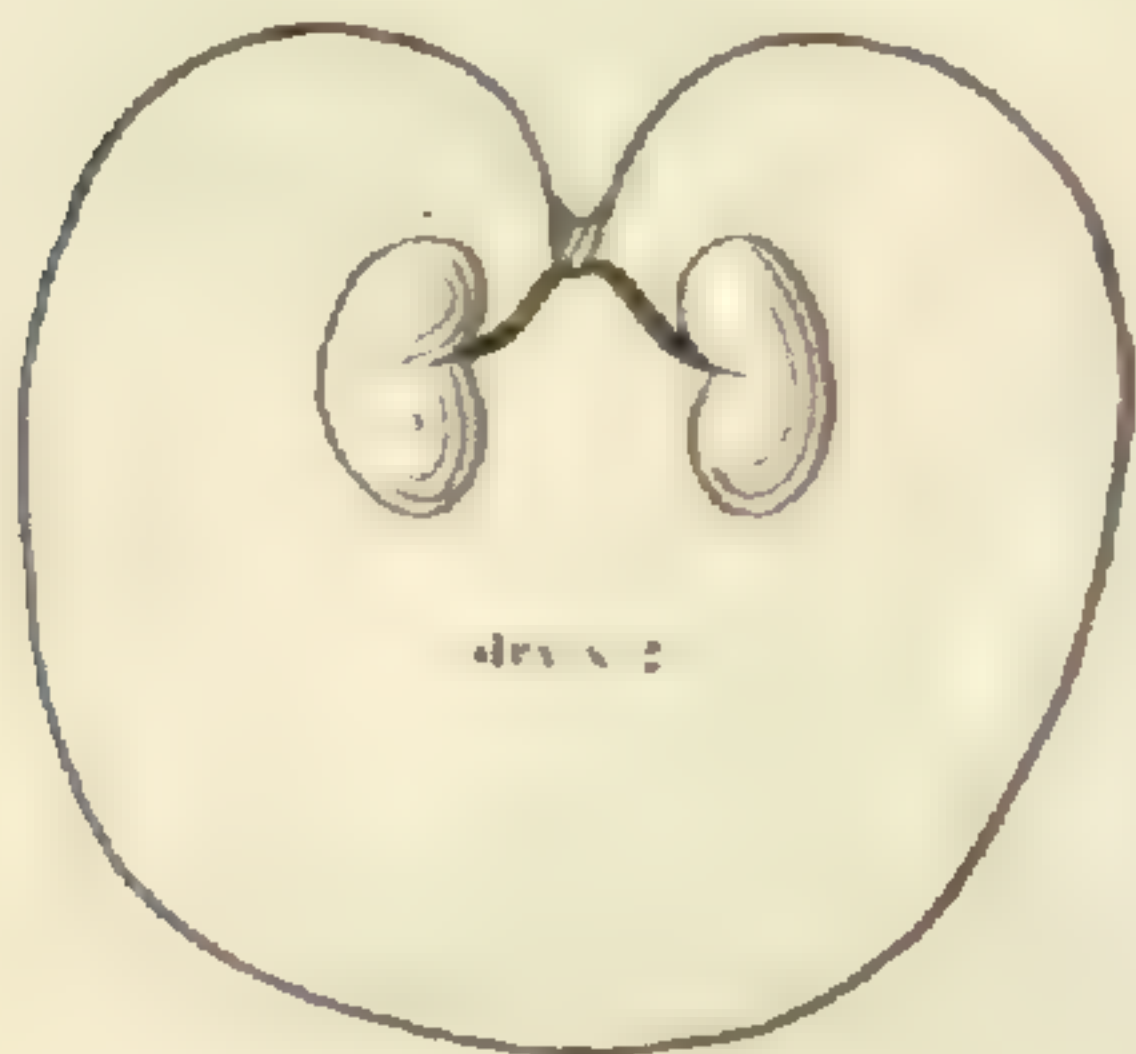


57 Crotalaria

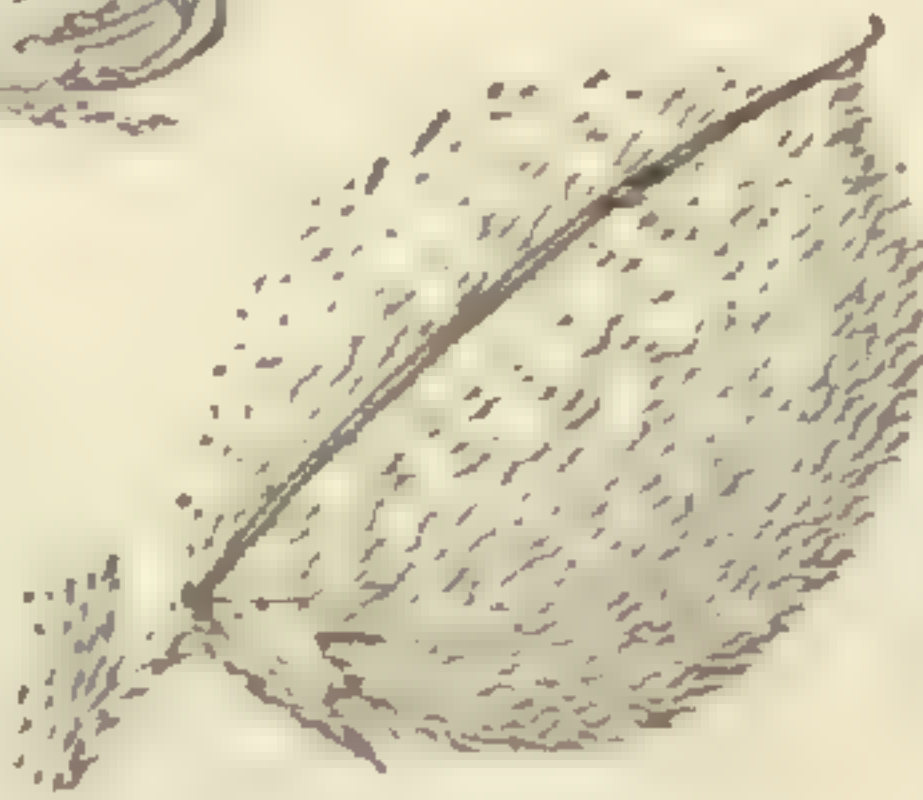
from tracing Hal. Kew.



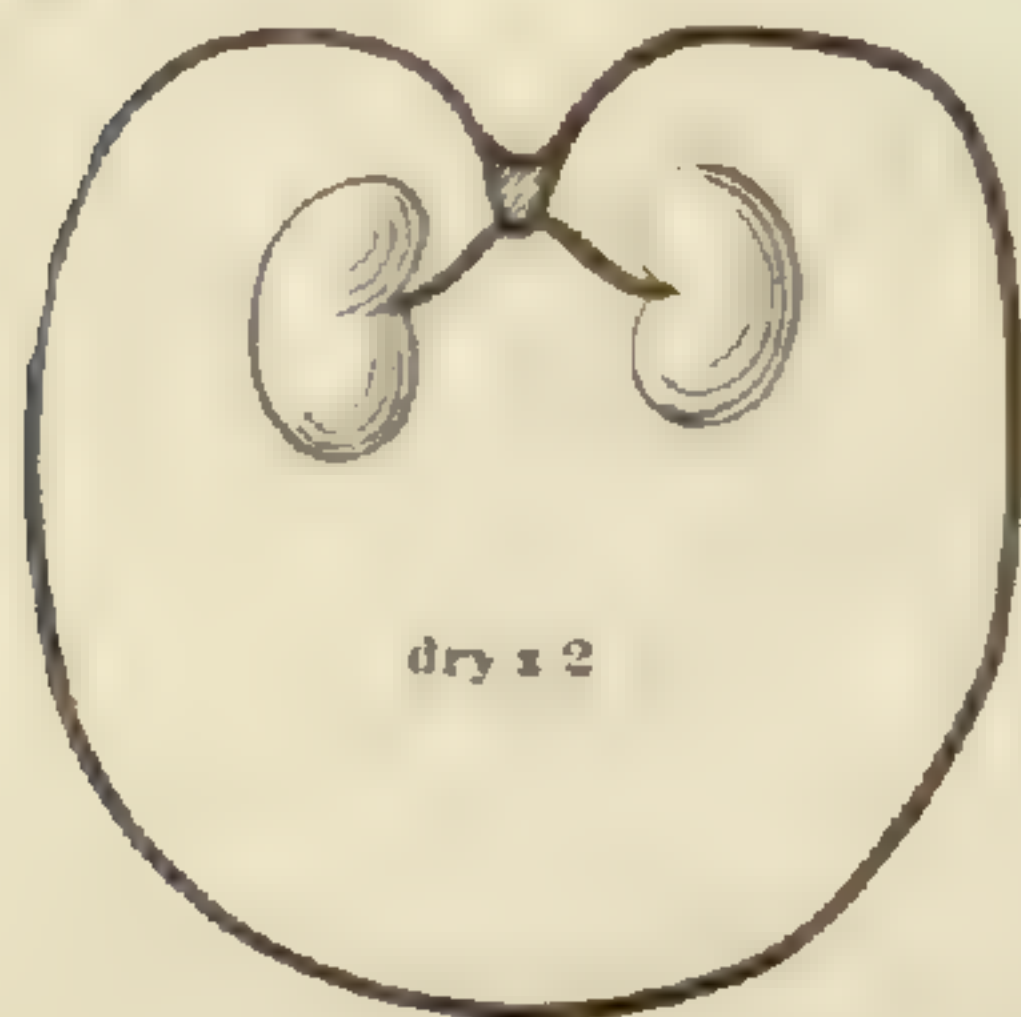
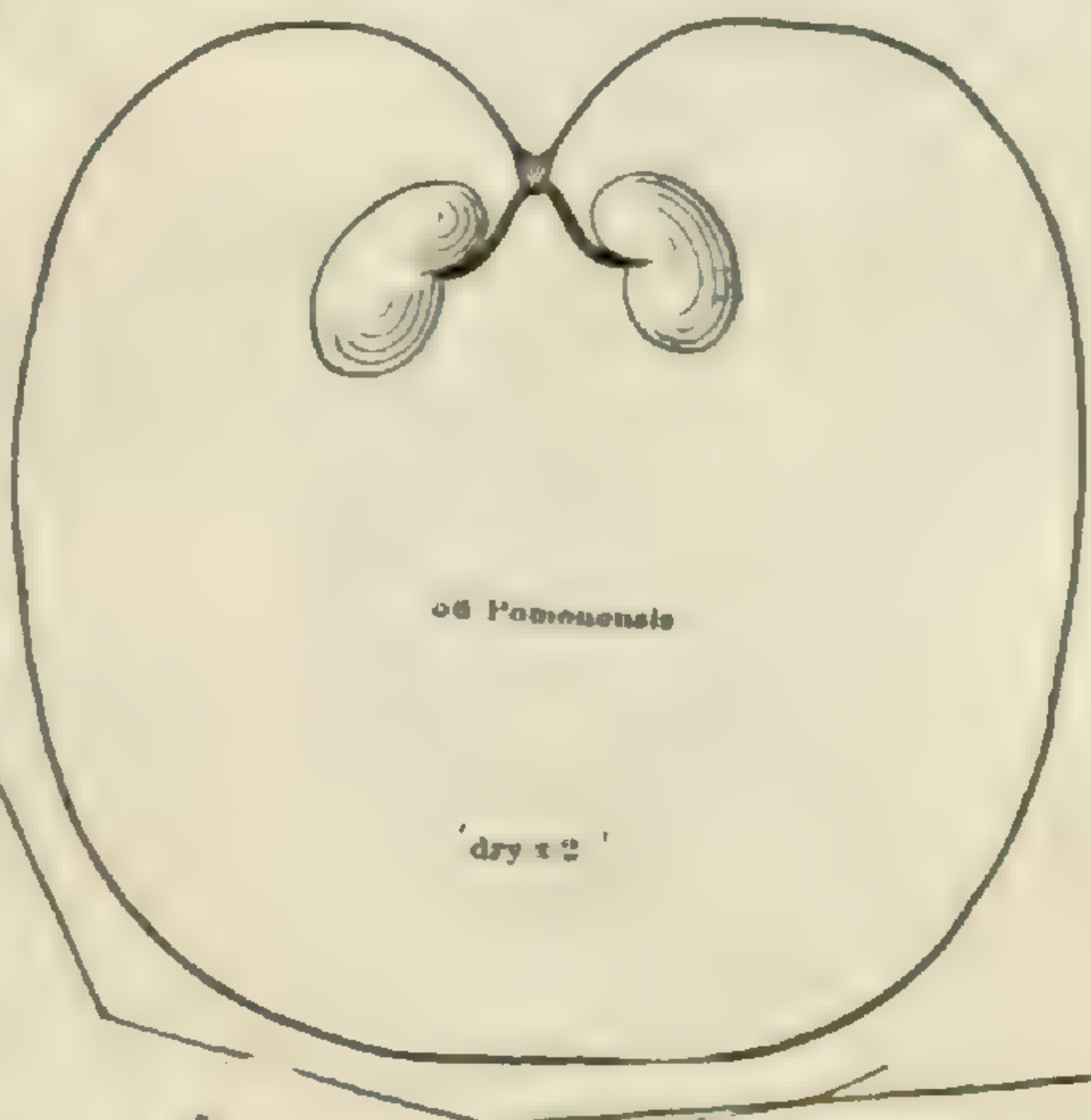
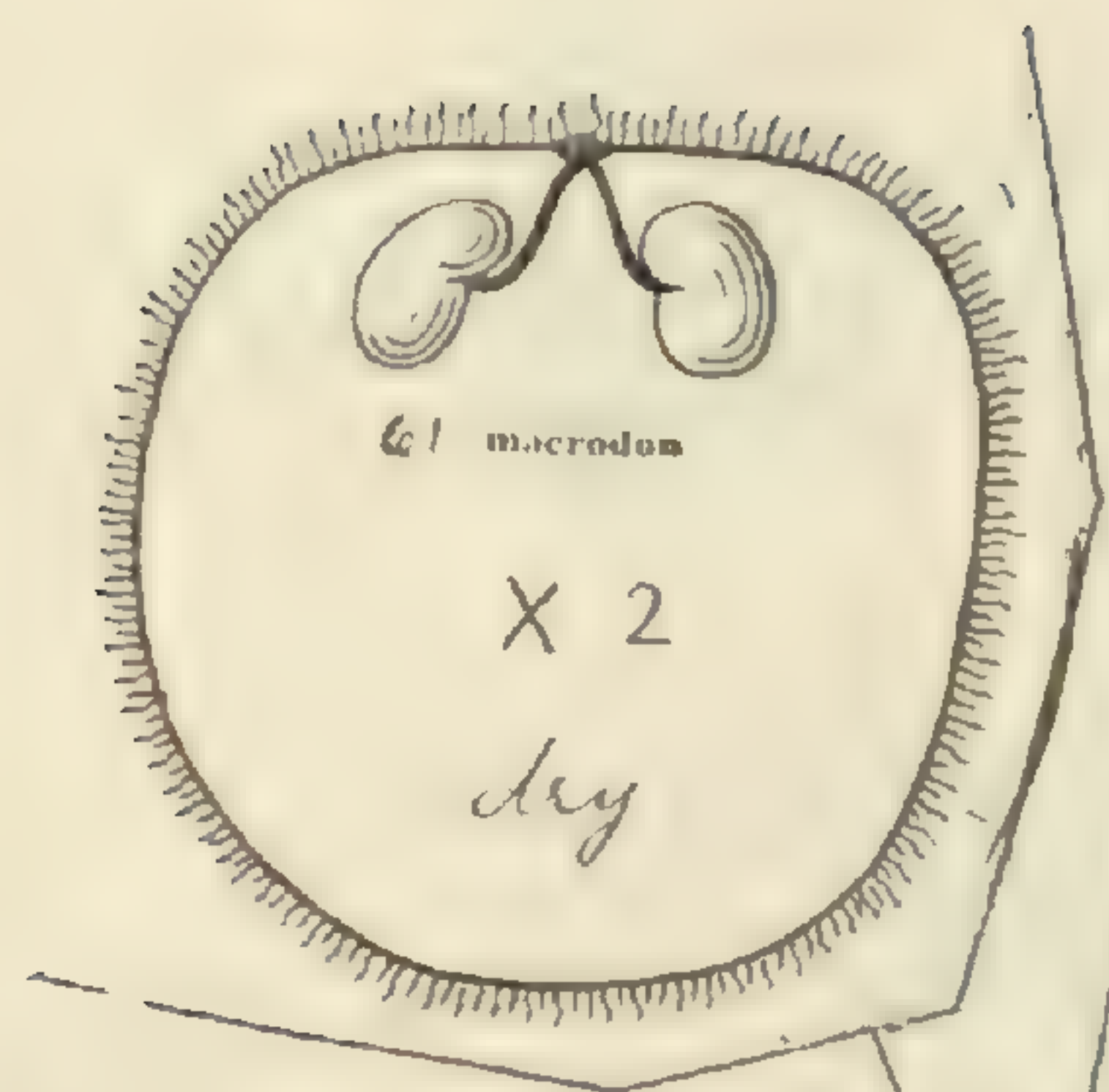
60 eocarpus



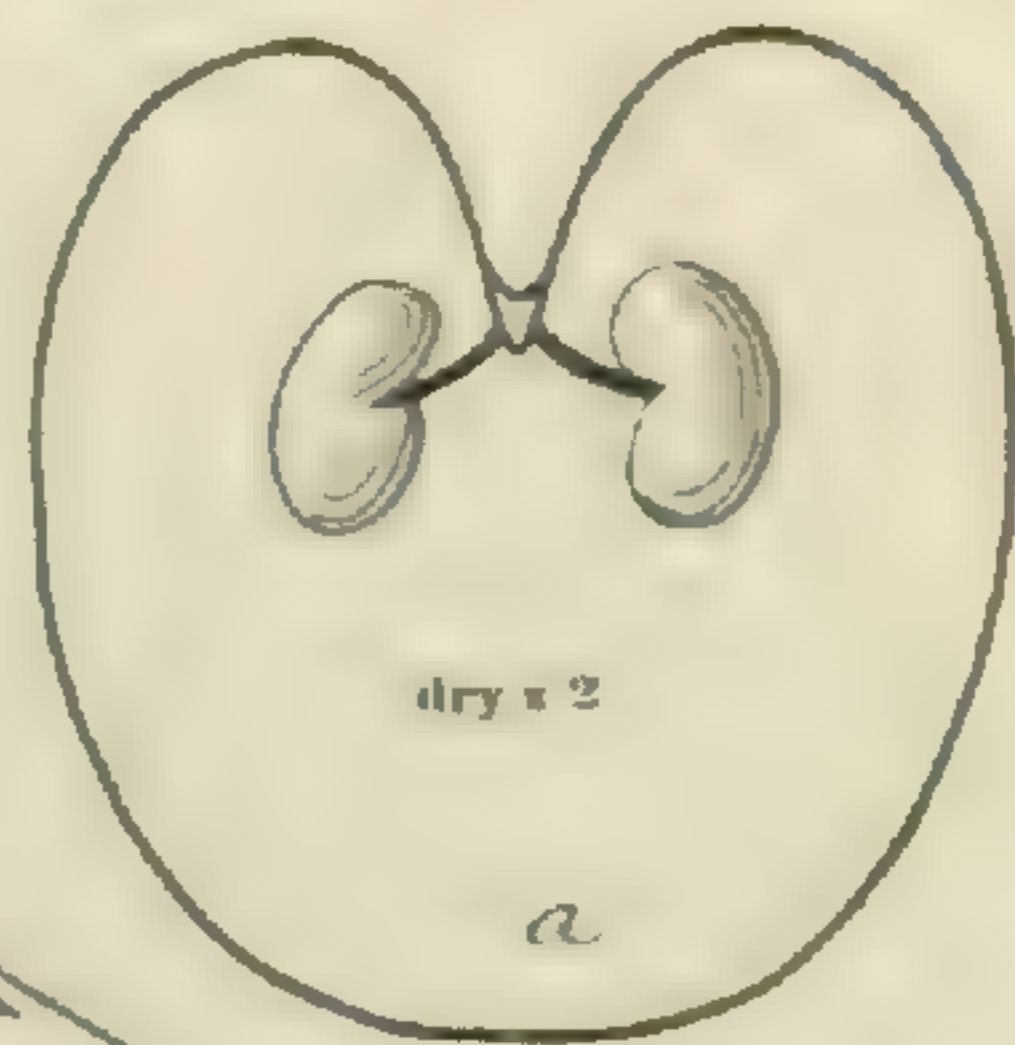
61 Microcarpus



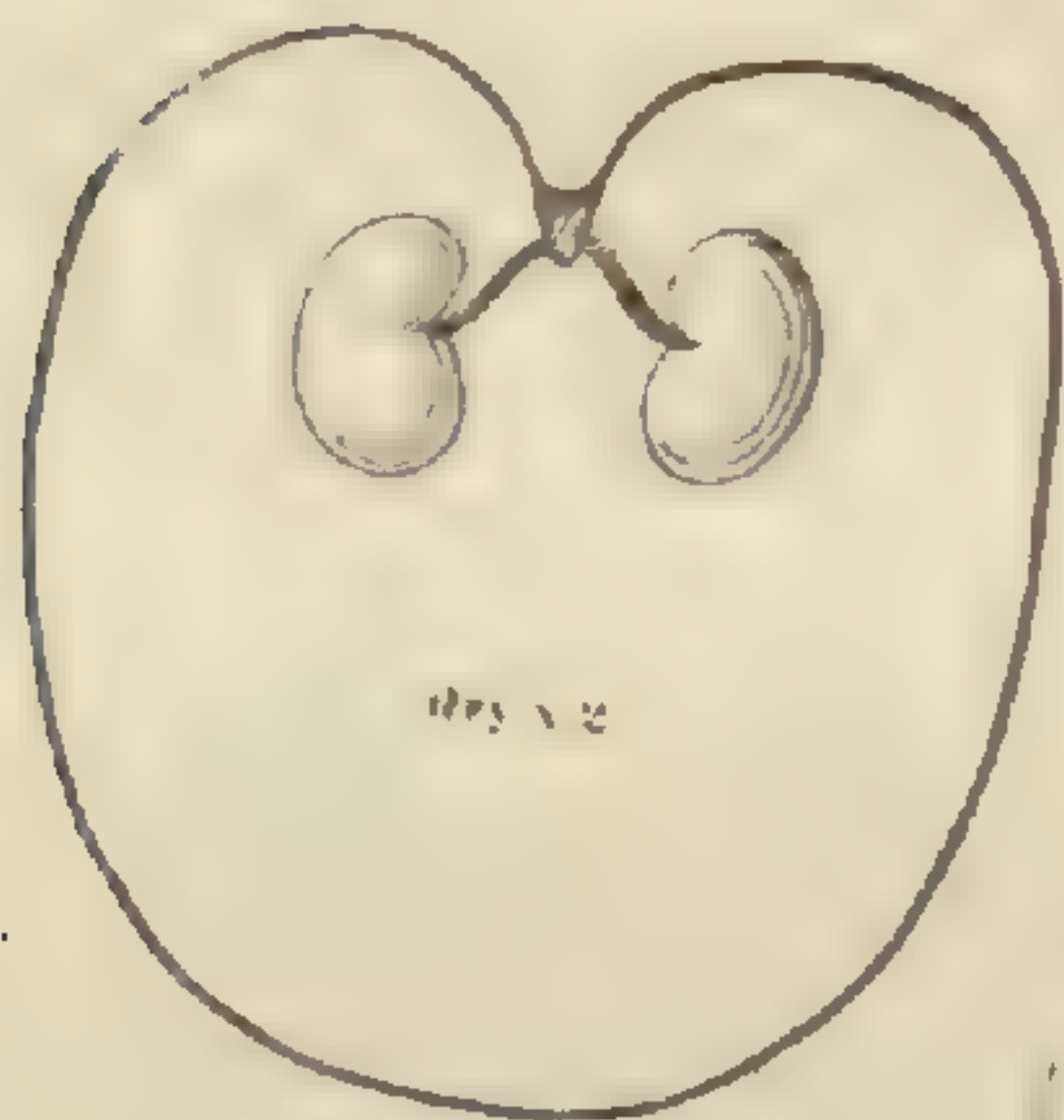
61 macrodon



A. Douglasi var. glaucum

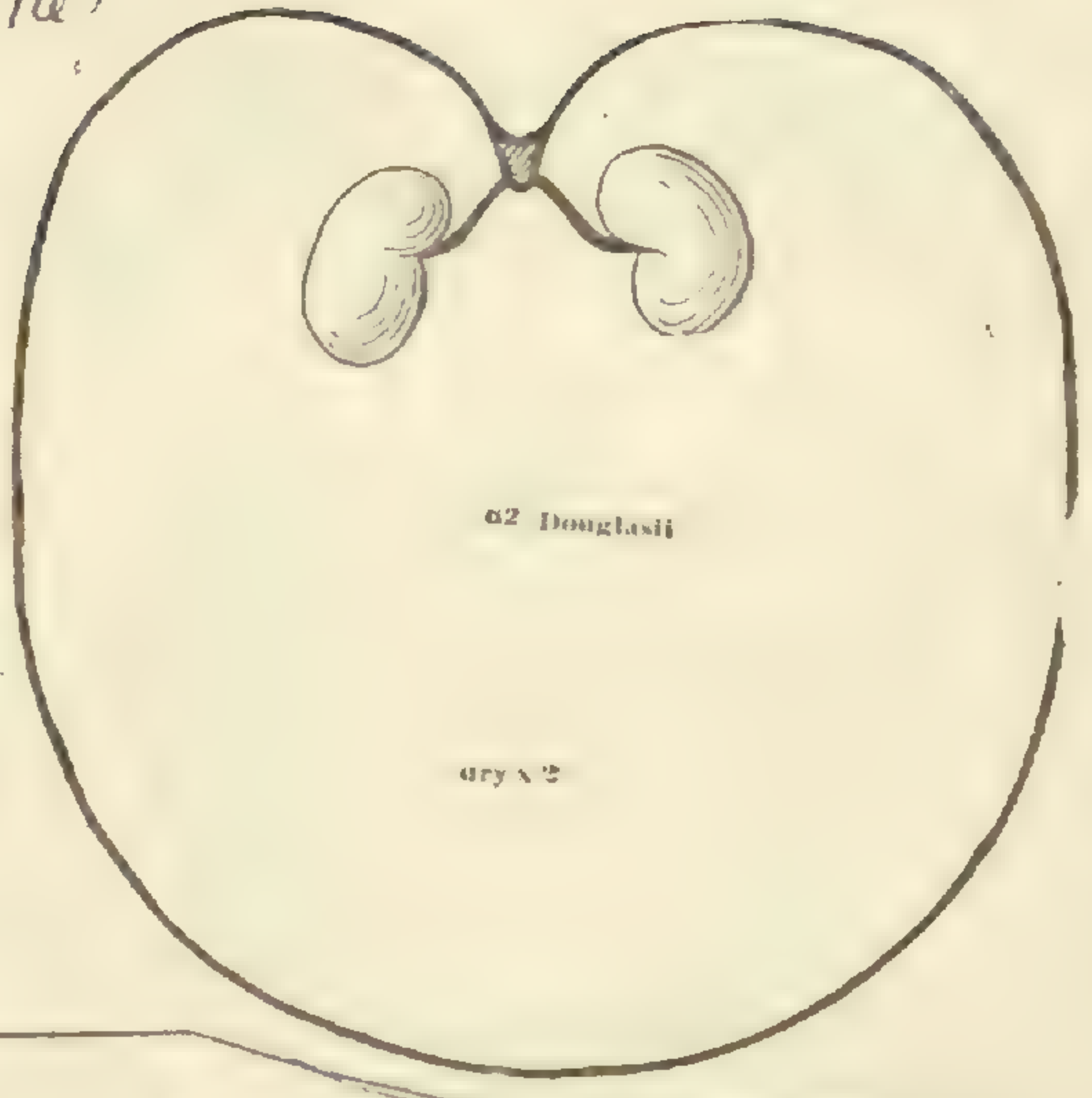


A. Douglasi var.



A. Douglasi var.

(16)



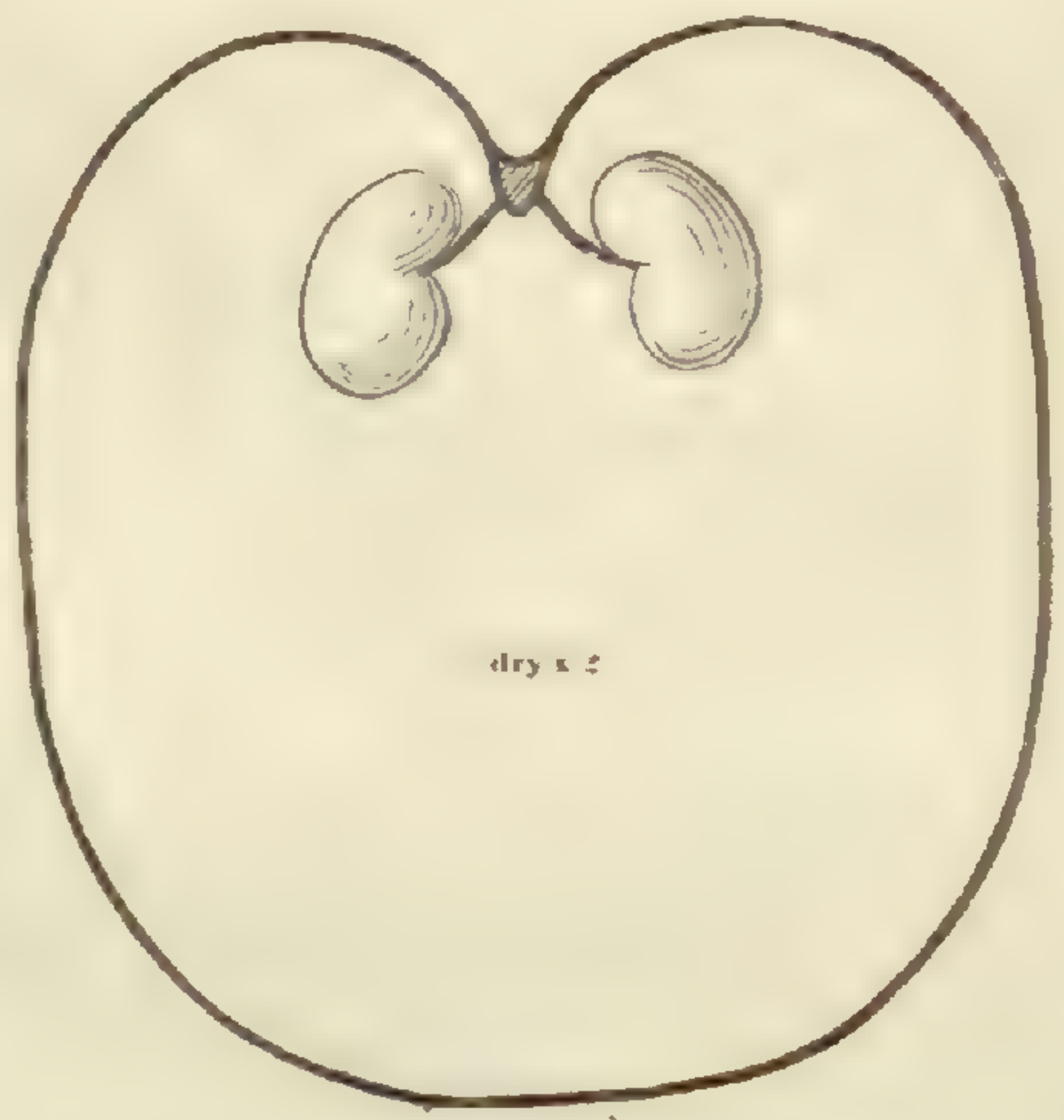
α2 Douglasii

dry x 2



dry x 2

A. Douglasii var. *aristata*



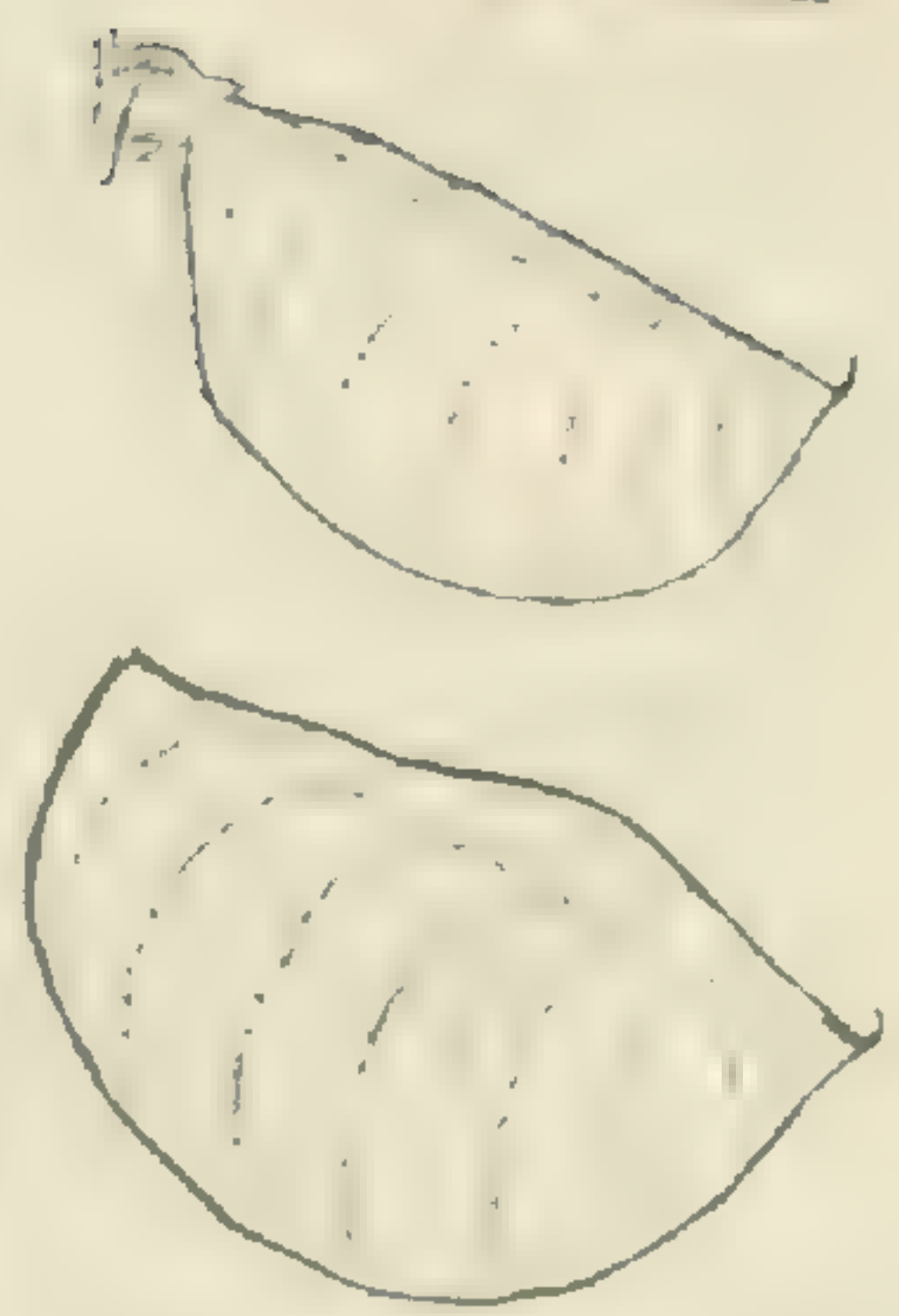
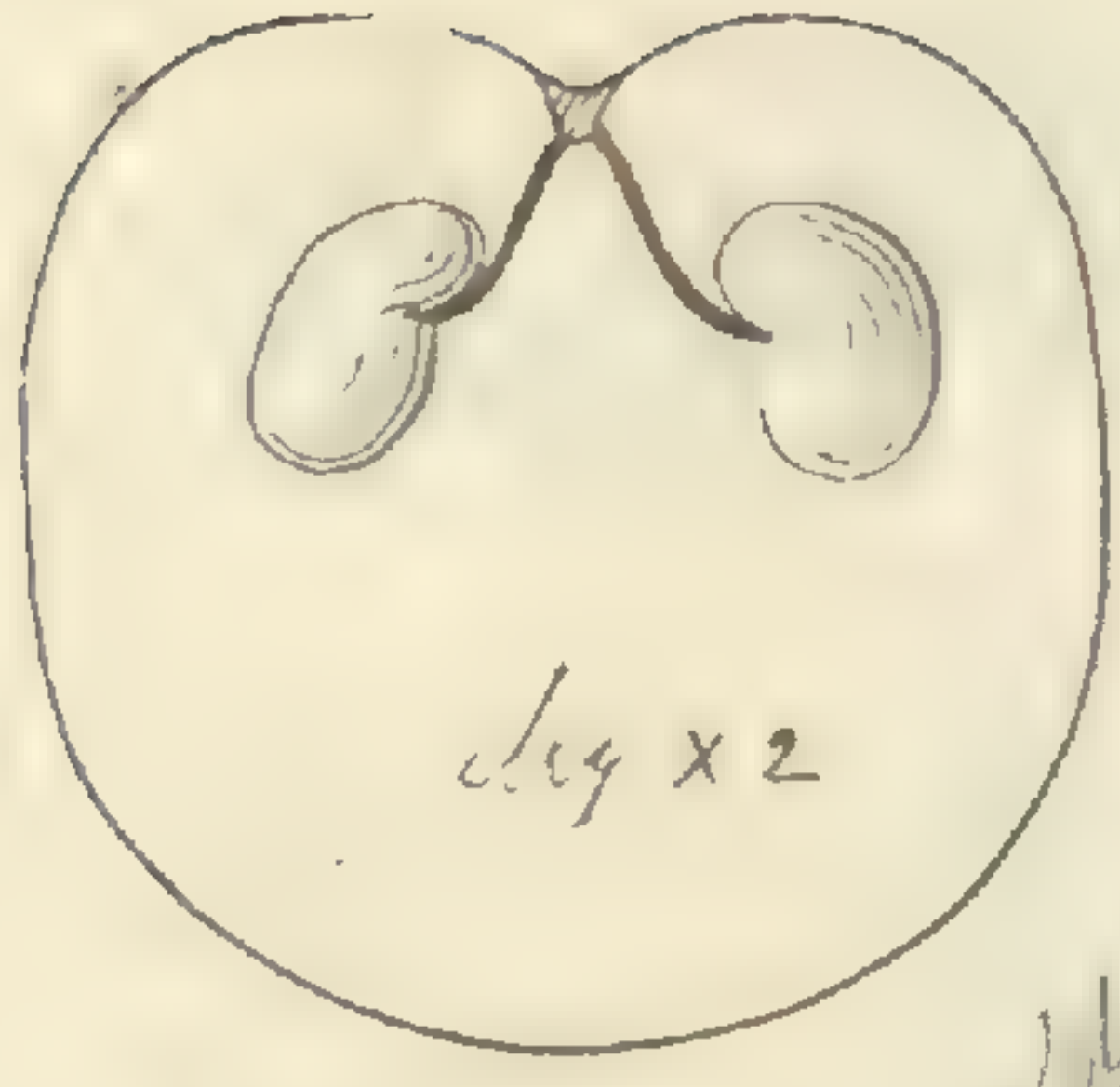
dry x 2

A. Douglasii var. *Tejonensis*

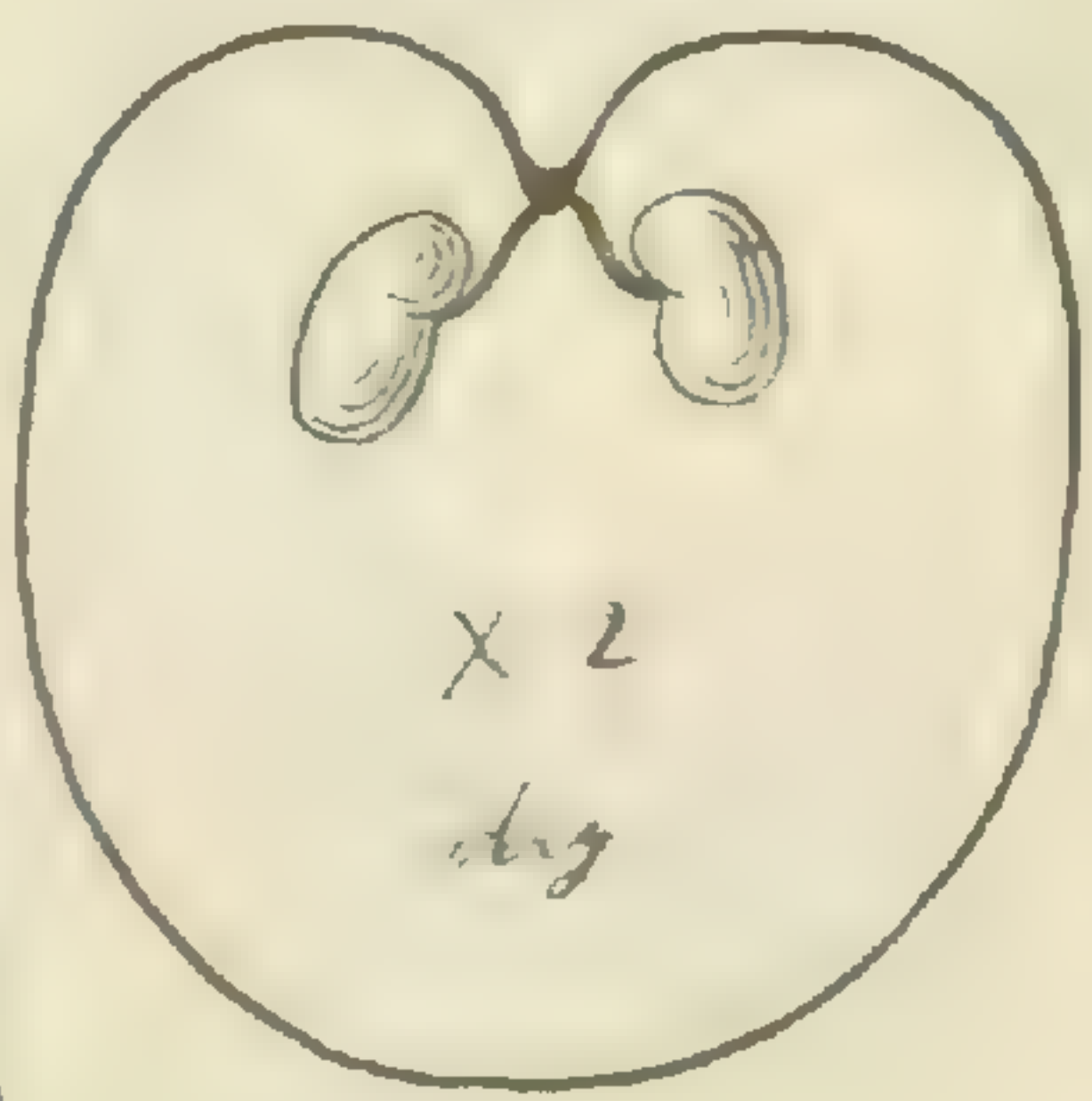


49 subincens

63 allochora



61 Wetherillii



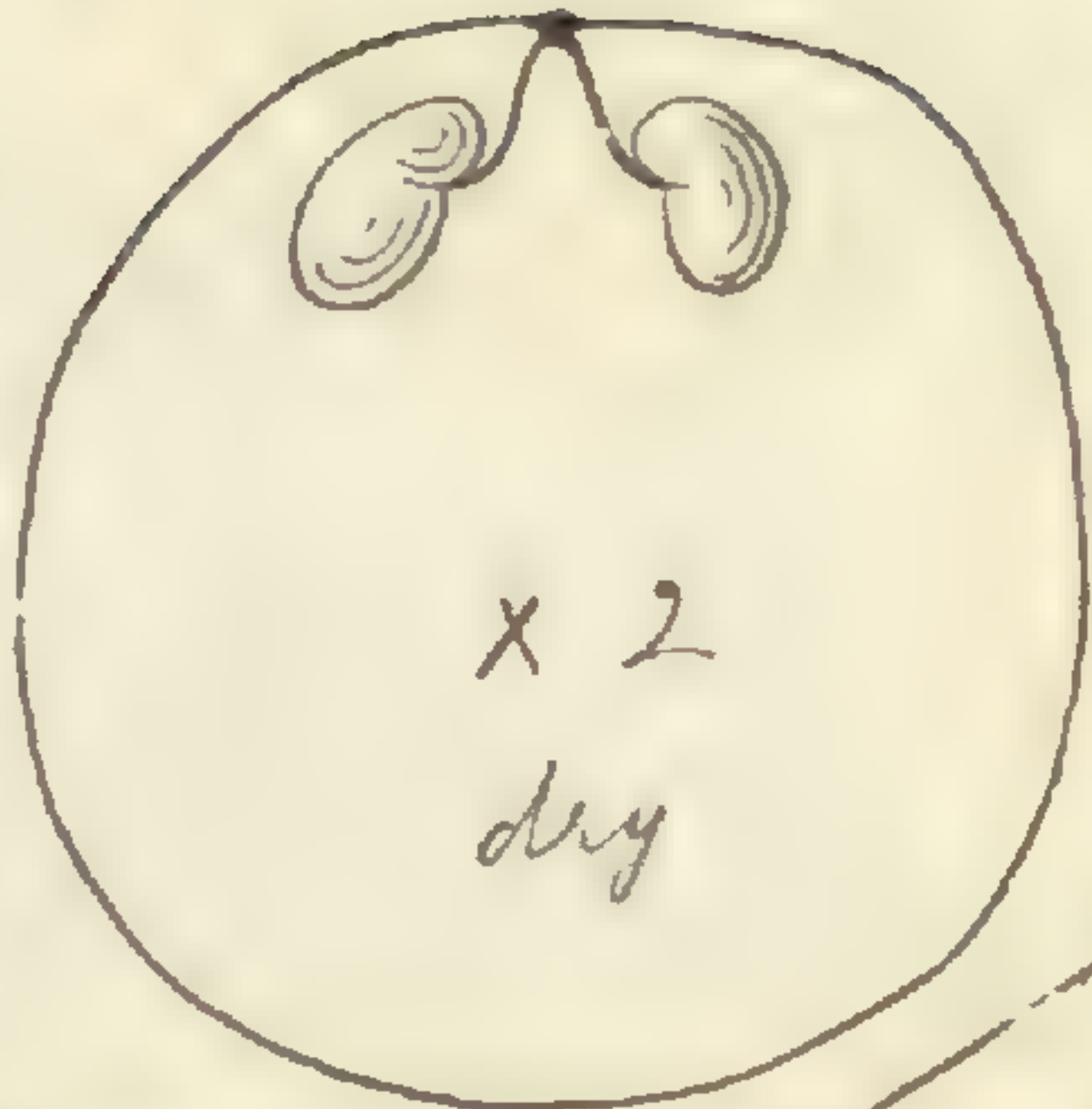
65 jeffreyi

66 Cusickii

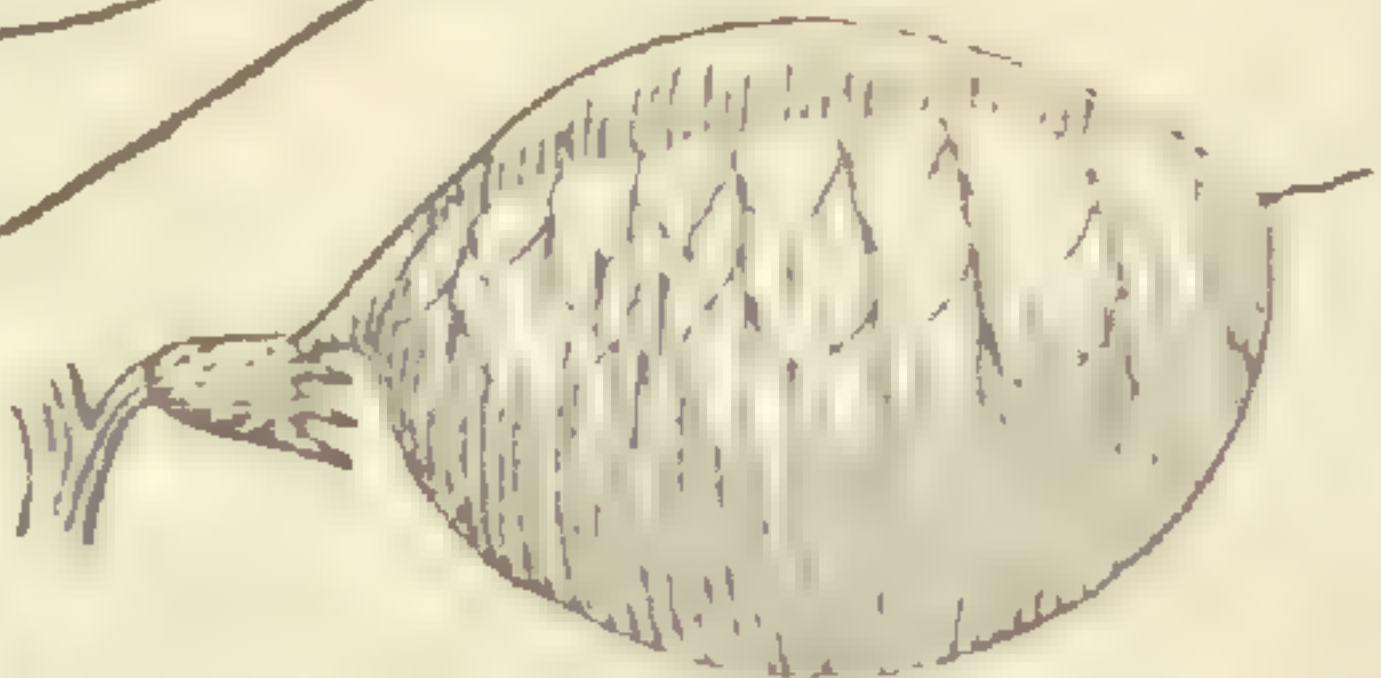




67 *hookerianus*



68 *Wahuei*



X 2
dry

69 *oxyphyus*



fruit



leaves under
magnifying

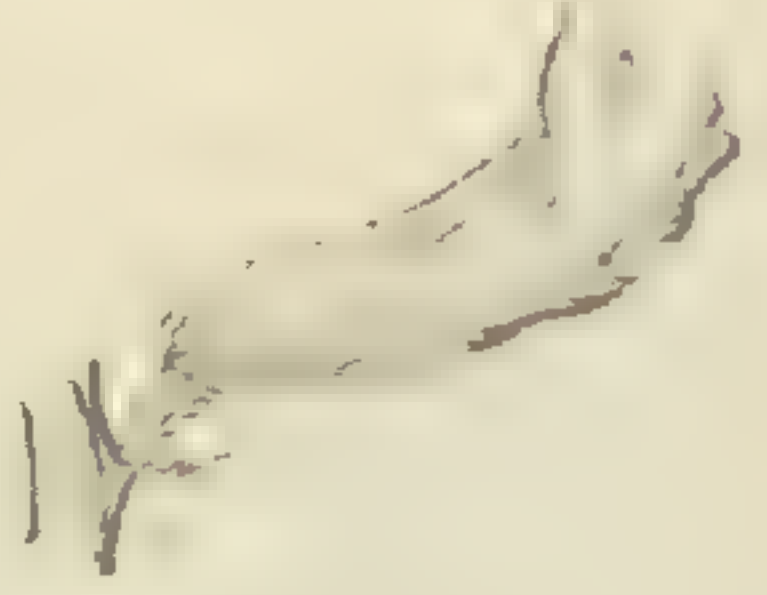
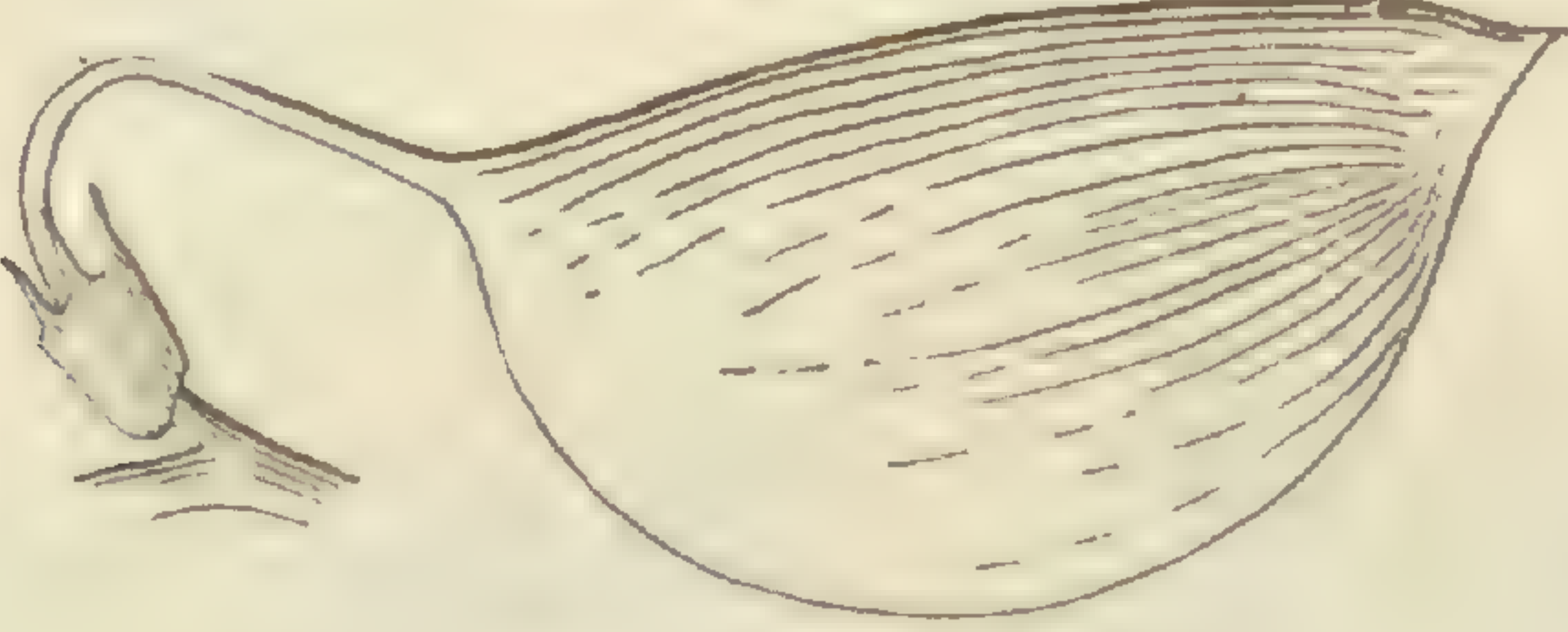


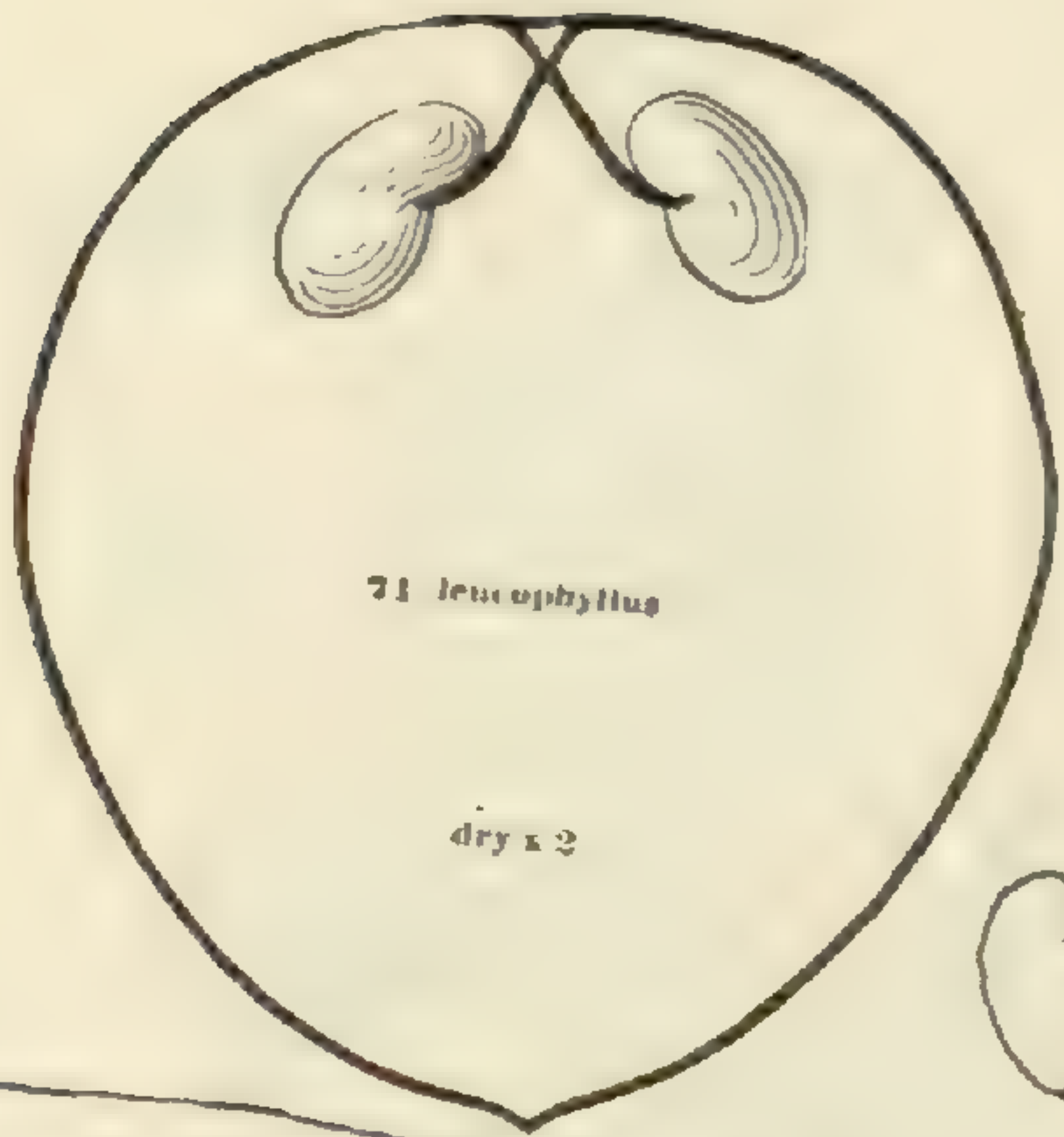
70 *trichopodus*



71 *capillus*

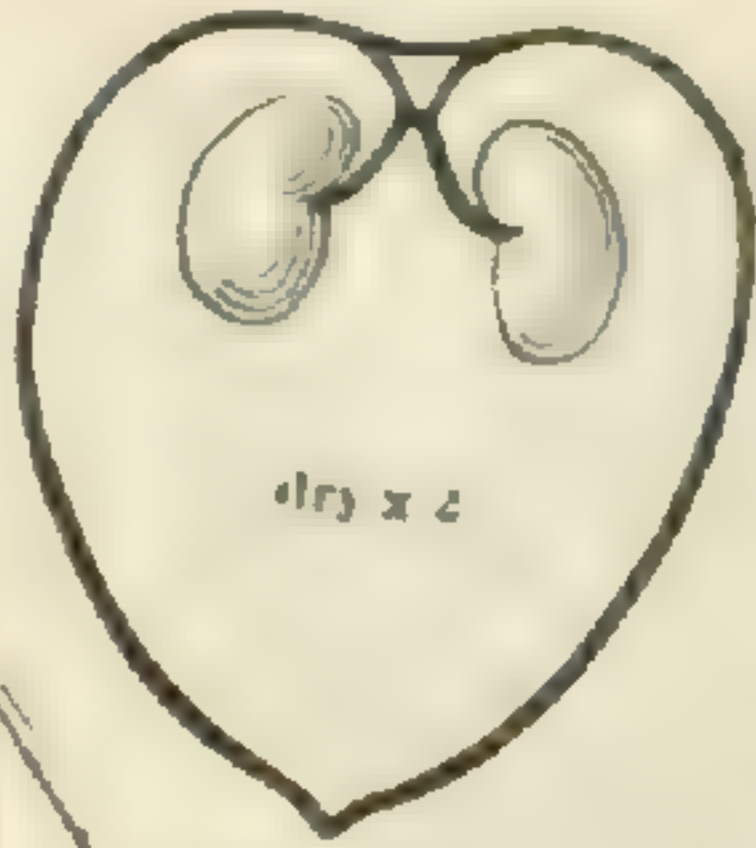
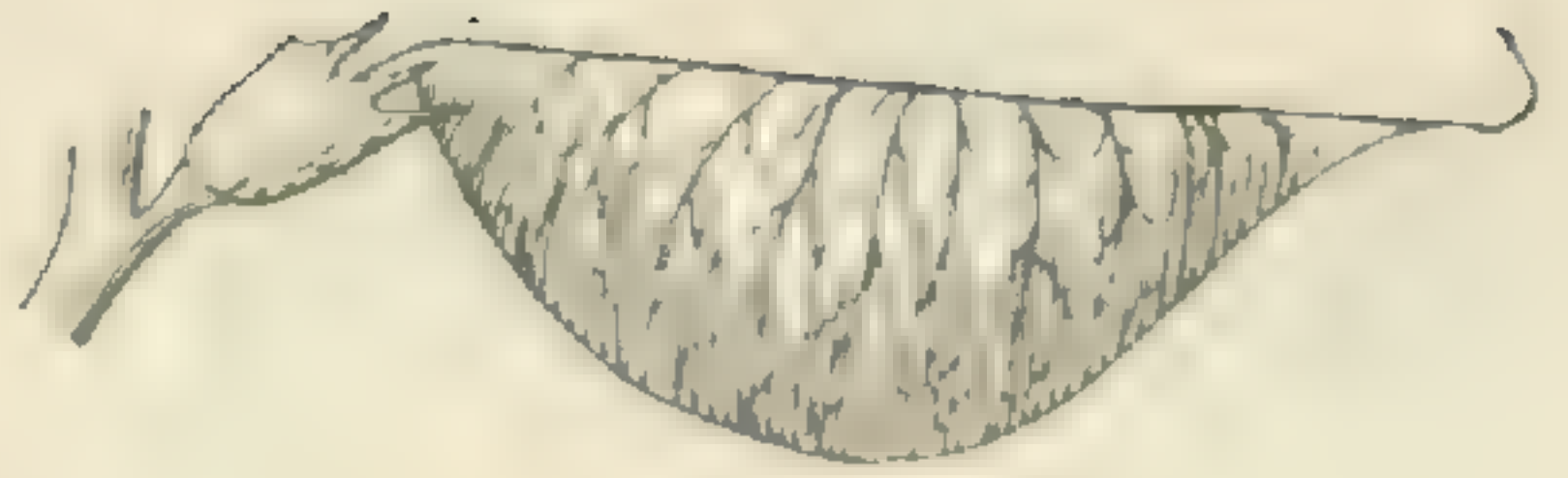
71 *leucophyllus*





71 leucophyllus

dry x 2

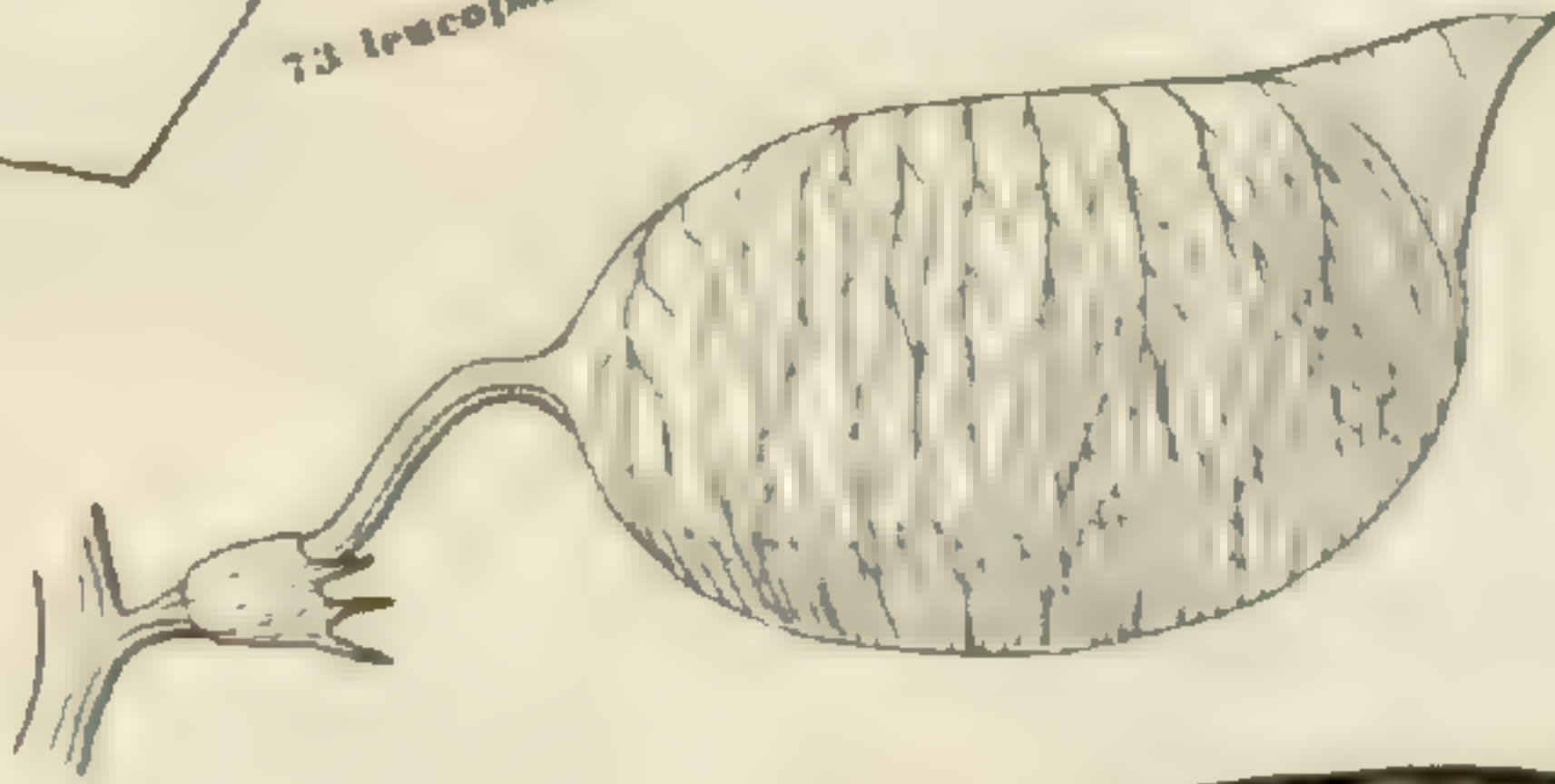


dry x 2

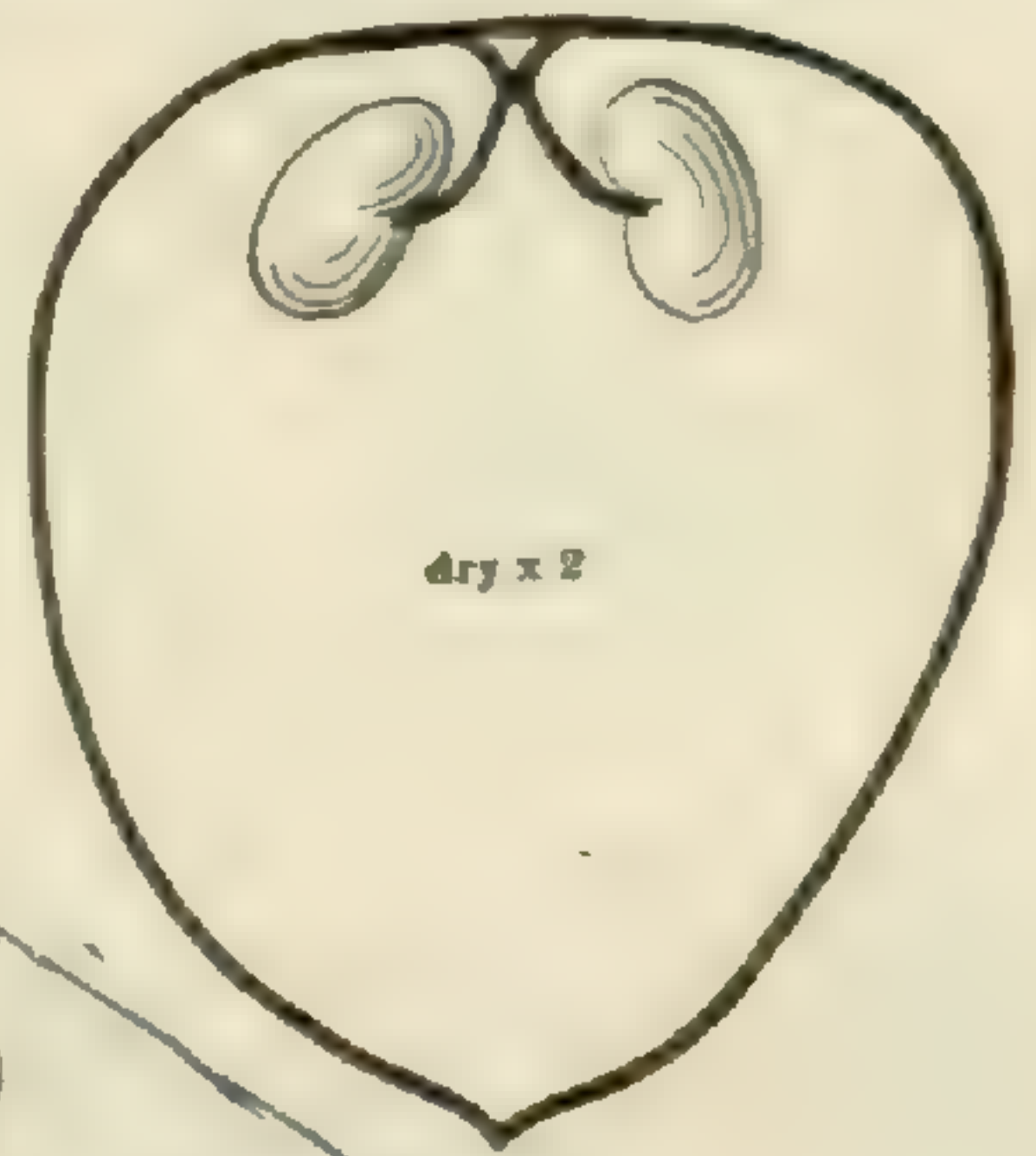
72 curtipes



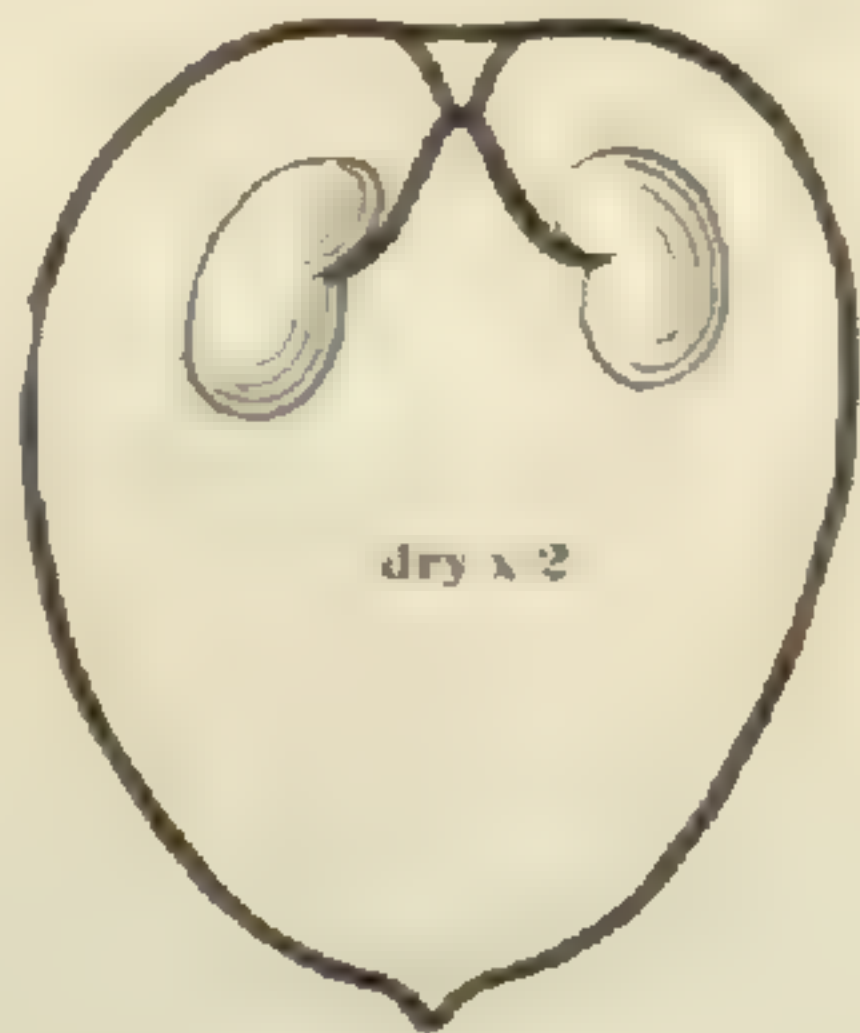
73 leucopala



var. lonchus

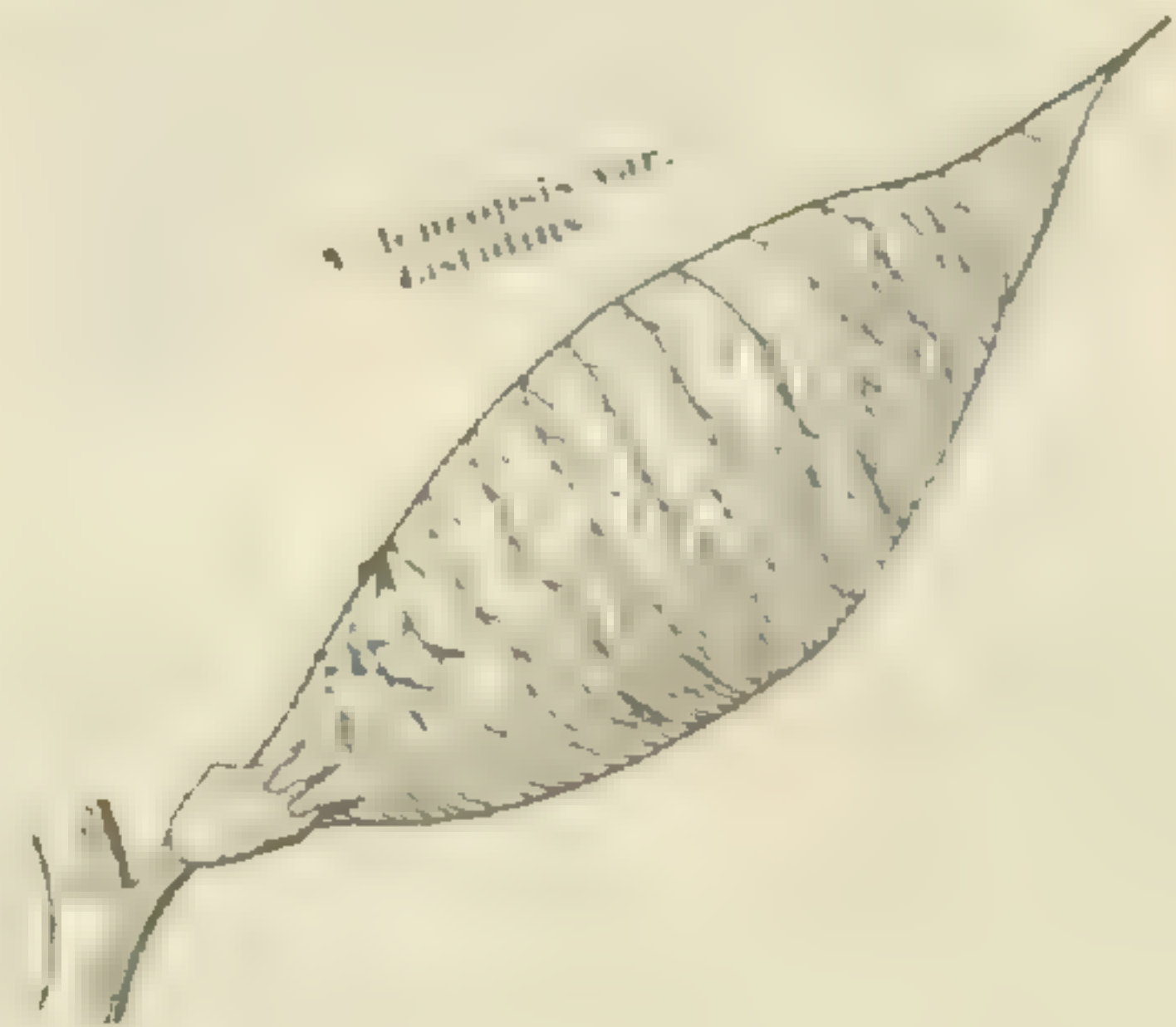


dry x 2

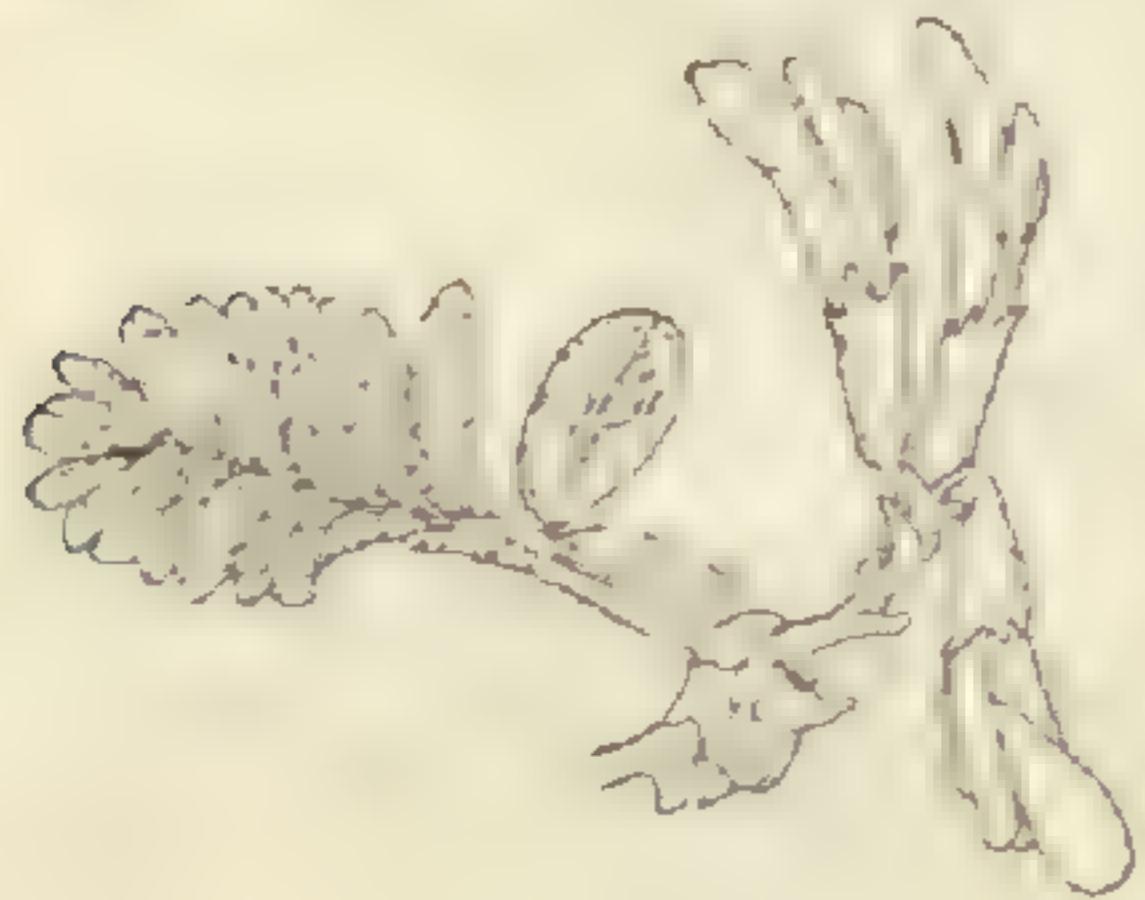
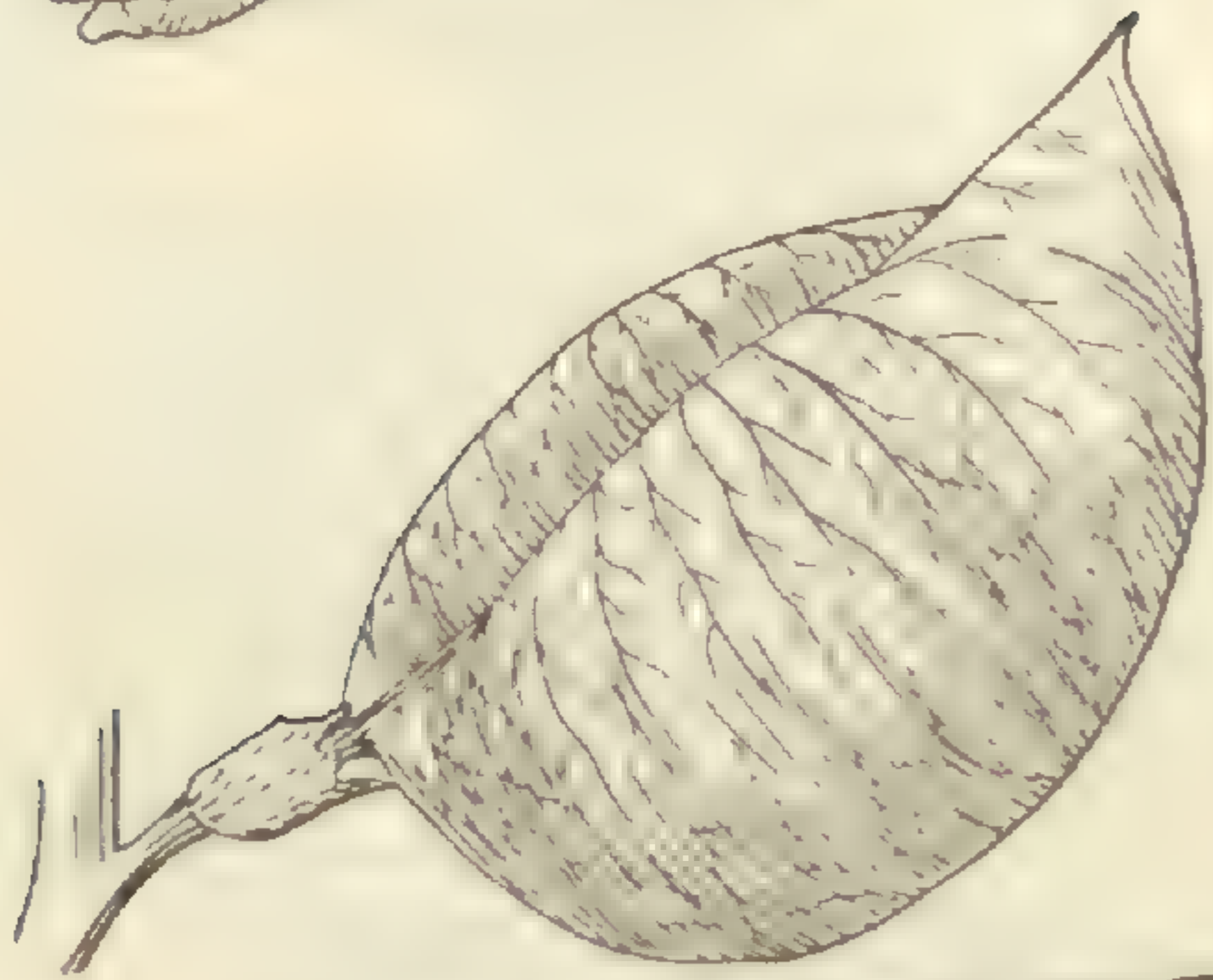


dry x 2

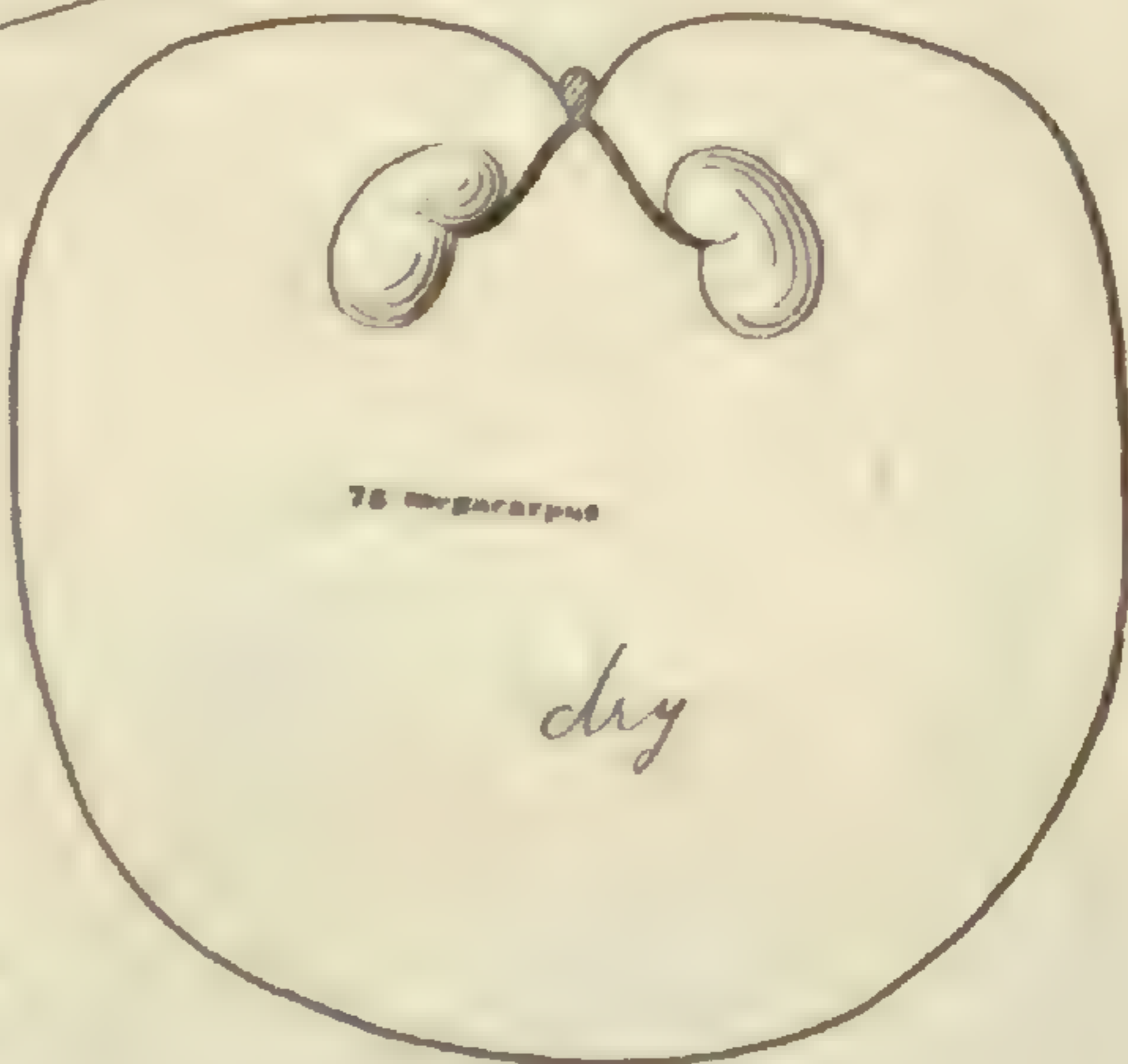
leucopala var. distulata



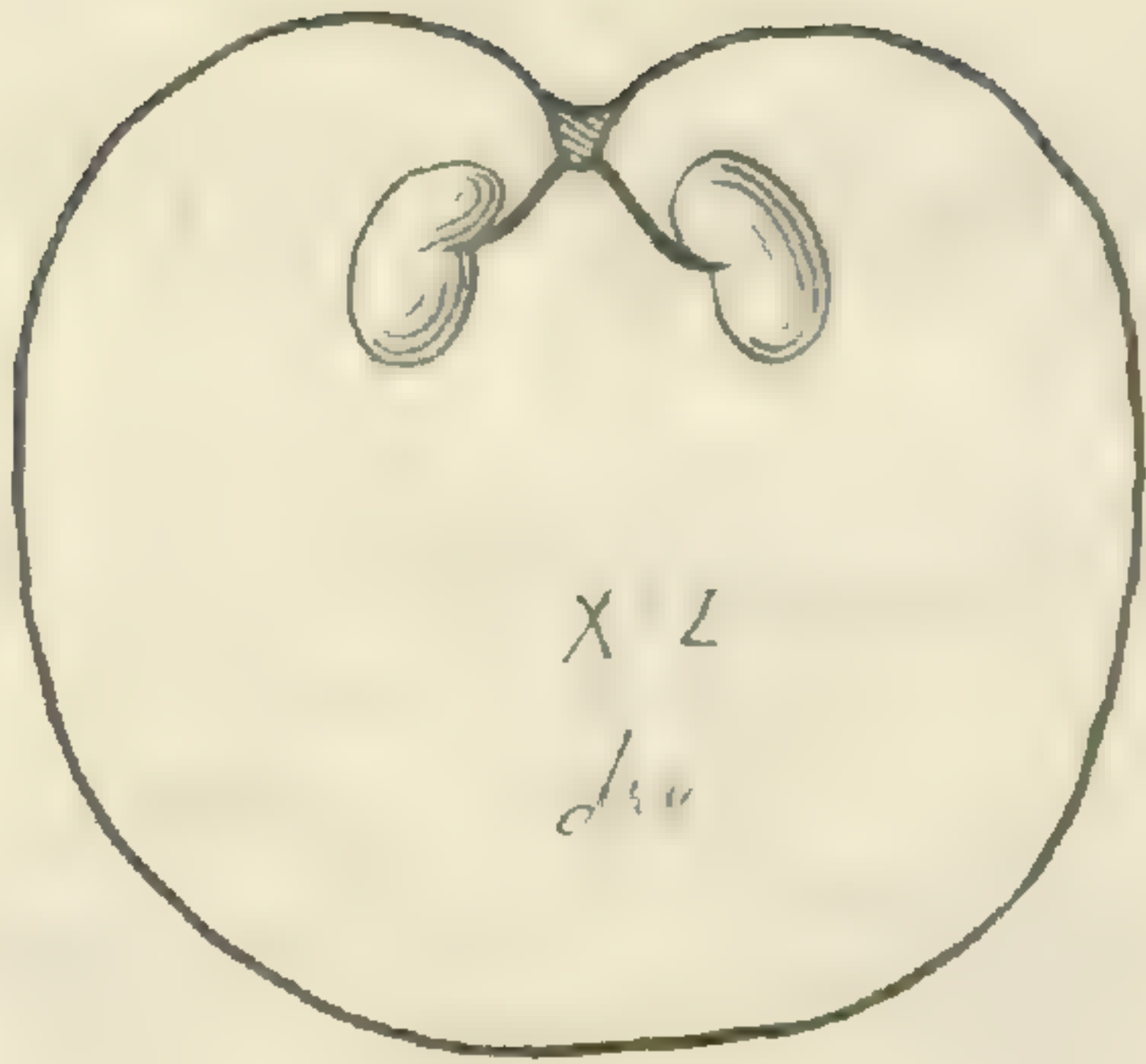
V. leucopis var. *brachypus*



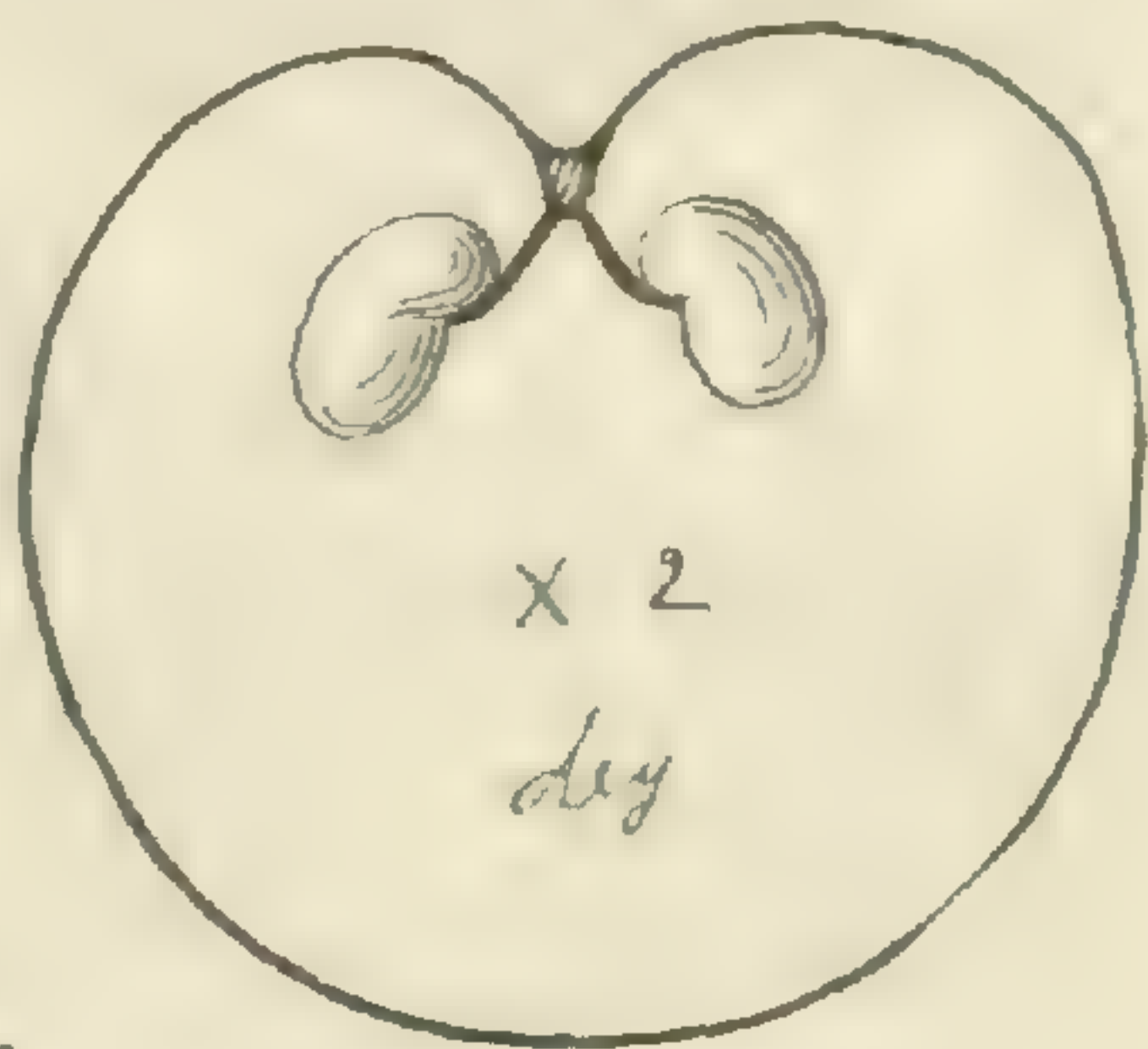
2-3 inches



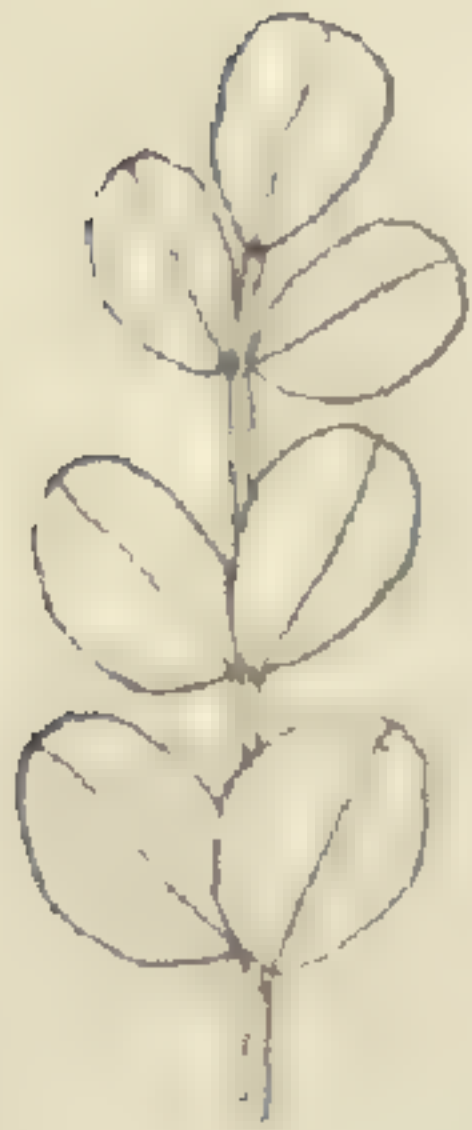
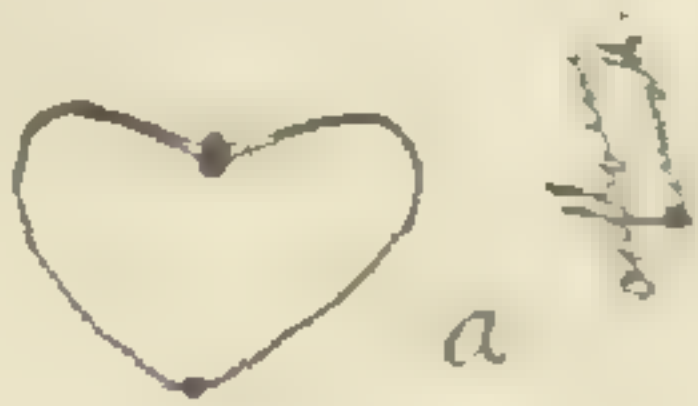
(21)



Var. Parryi



10 eophorus



(22)

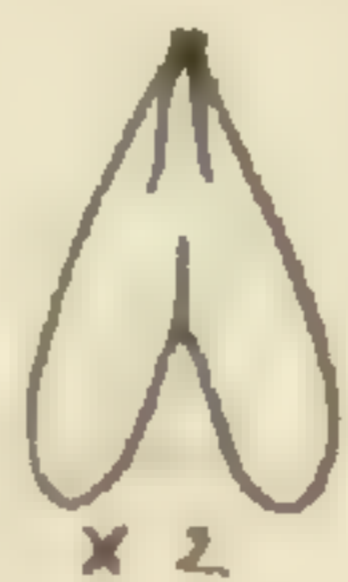
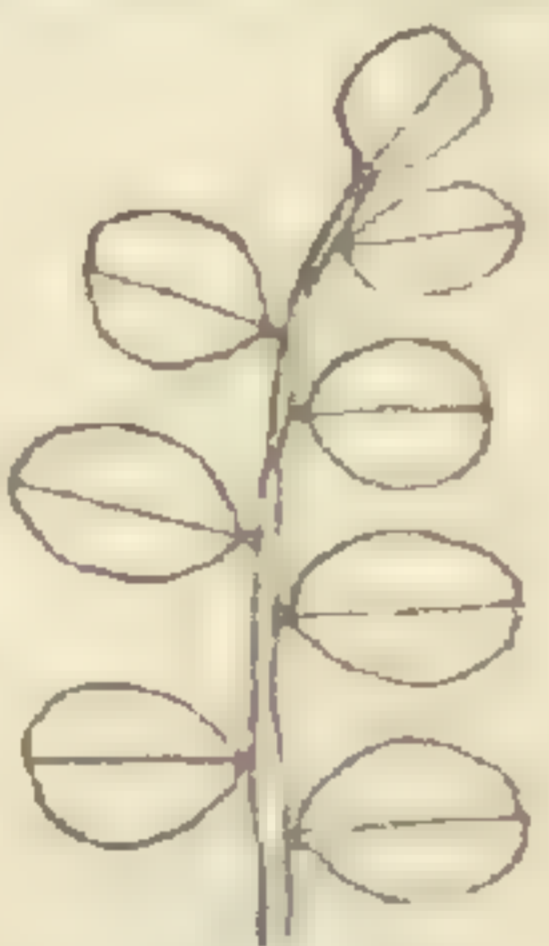


Var. caulescens



Var. artipes

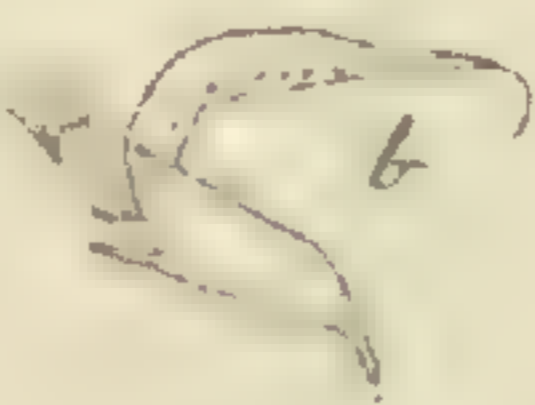
77 Beckwithii



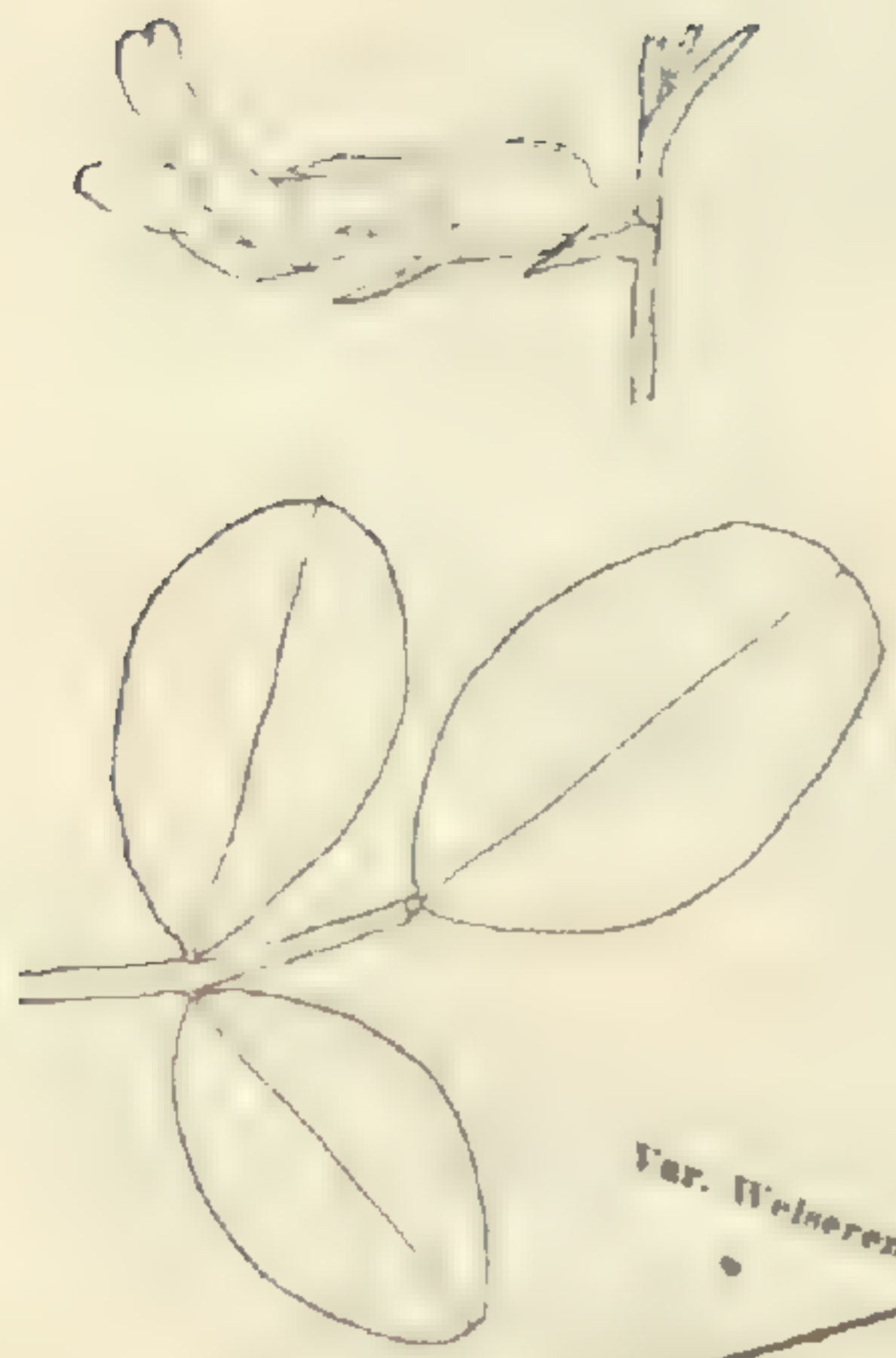
78 ciliolata



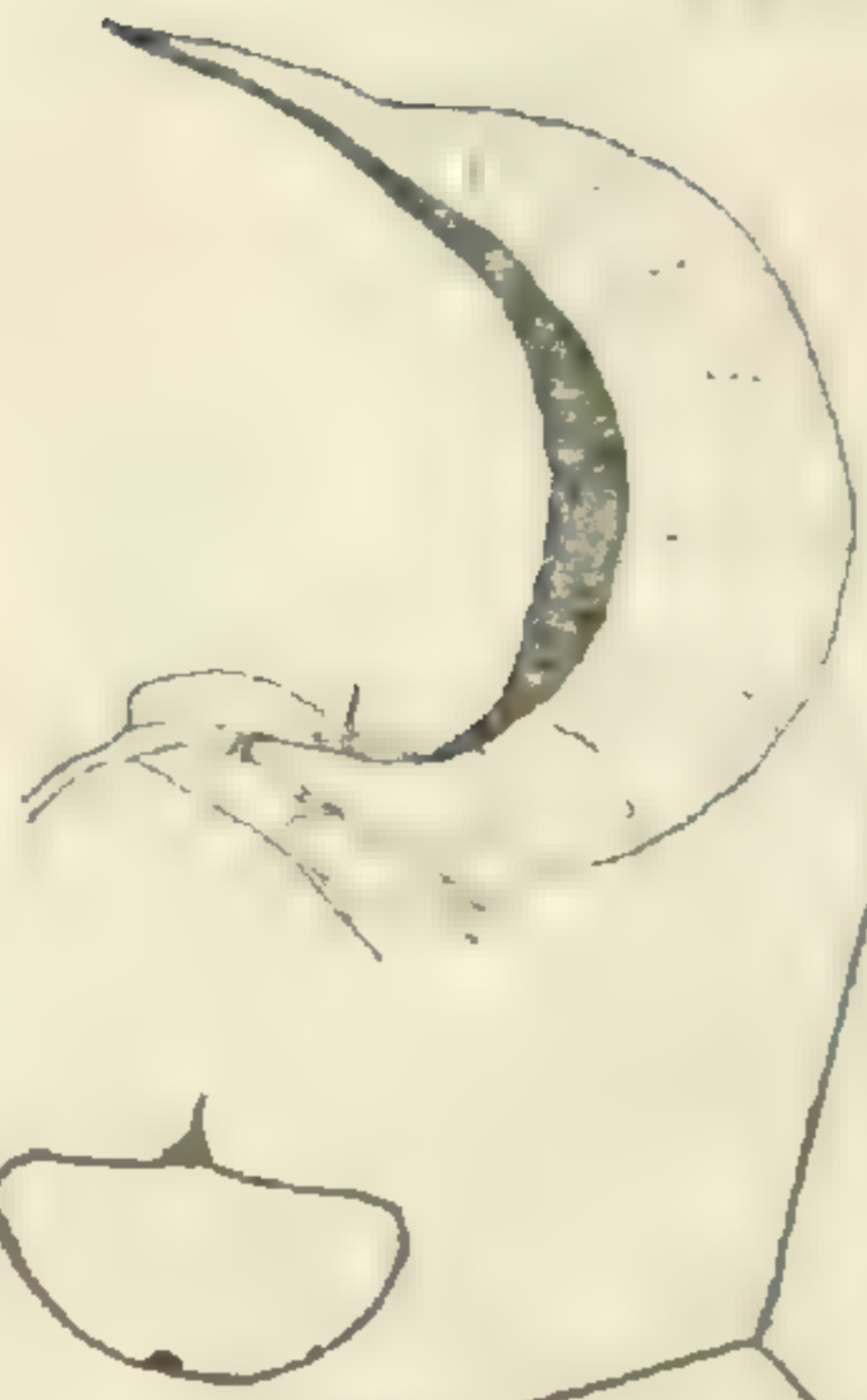
Var. purpurea



79 Craigi



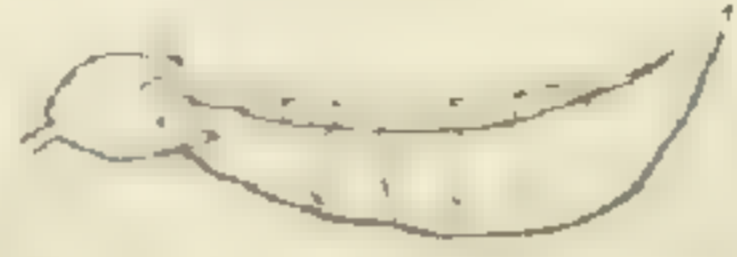
Var. *Winklerensis*



80 *lentiginosa*



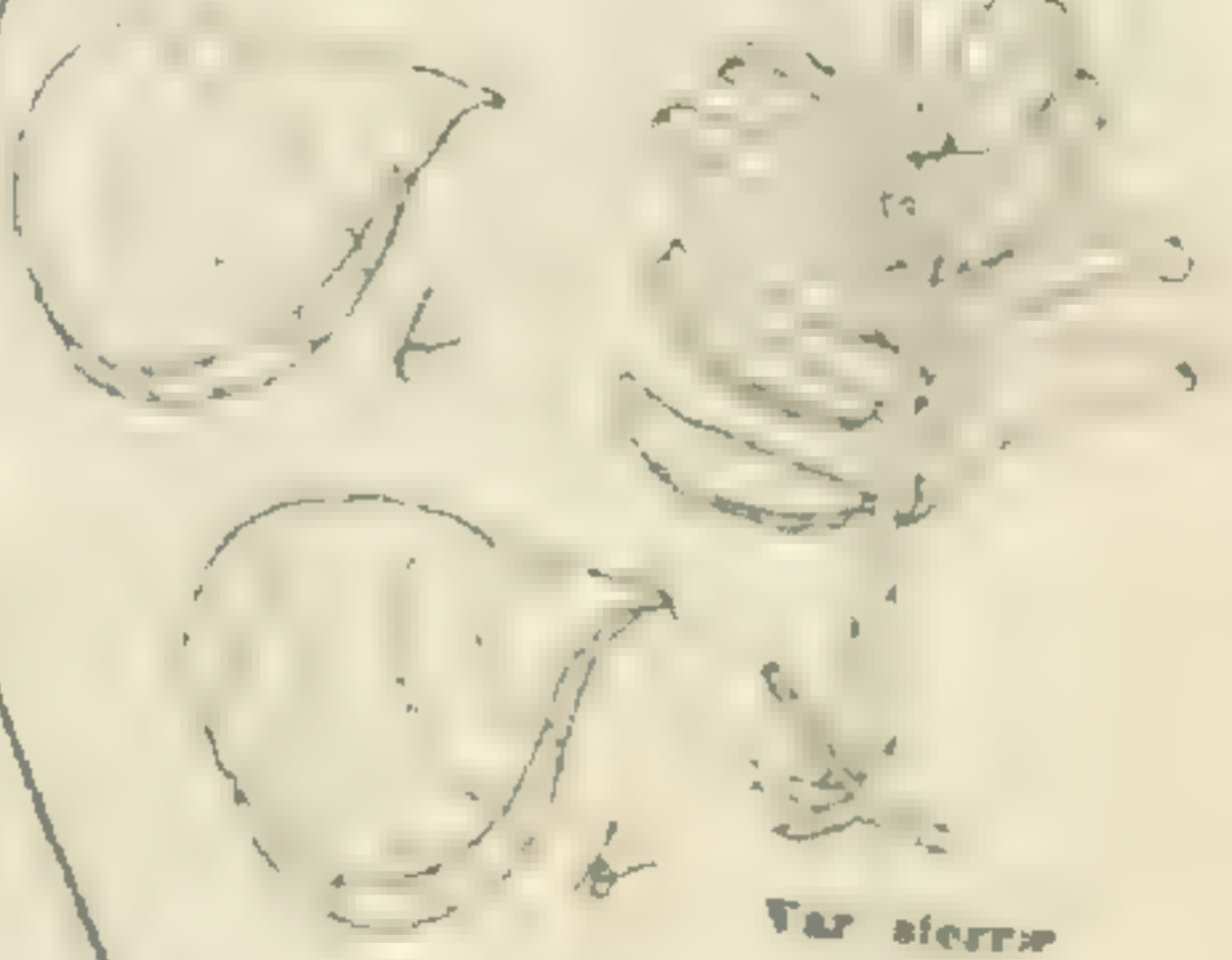
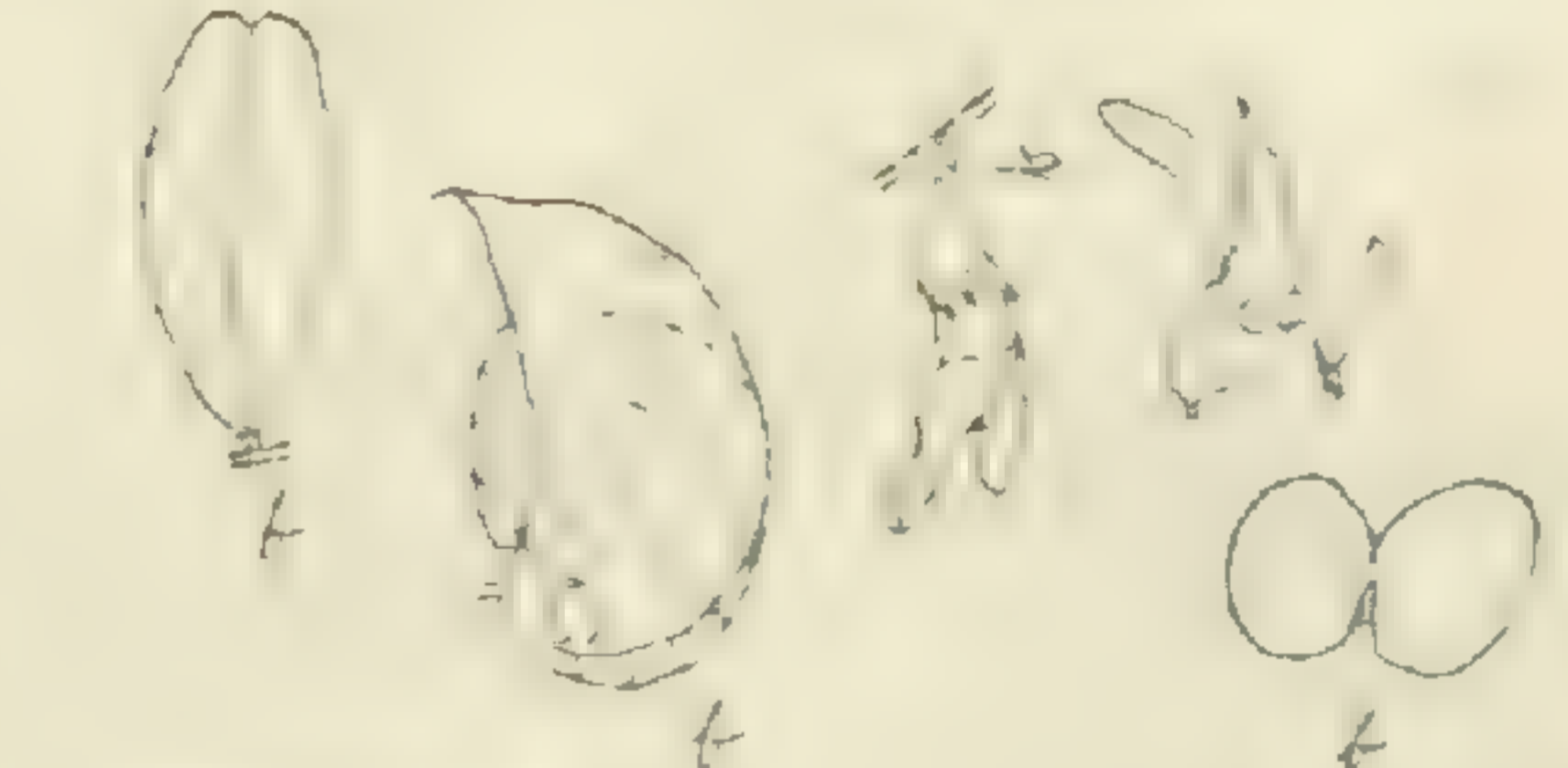
Var. *ineptus*



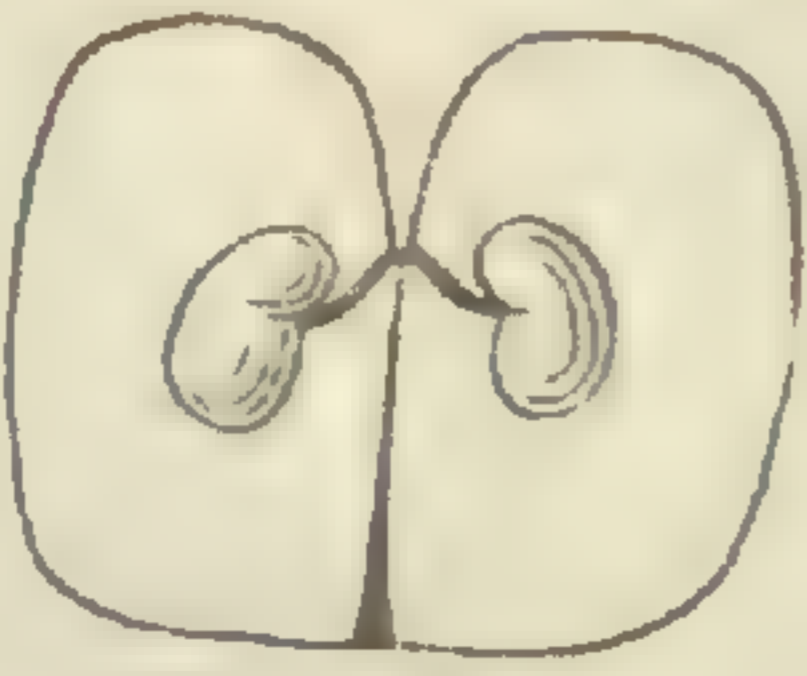
Var. *diaphanus*



Var. *albifolia*



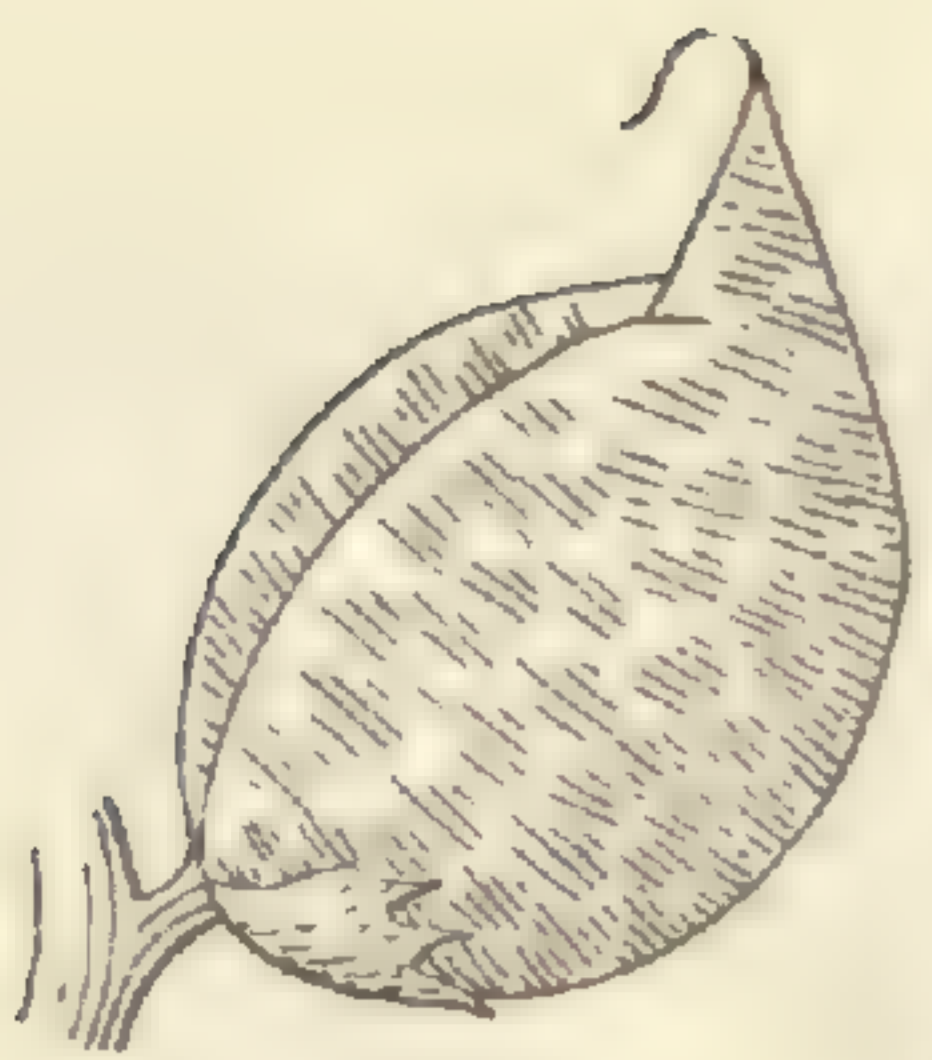
Var. *sterna*



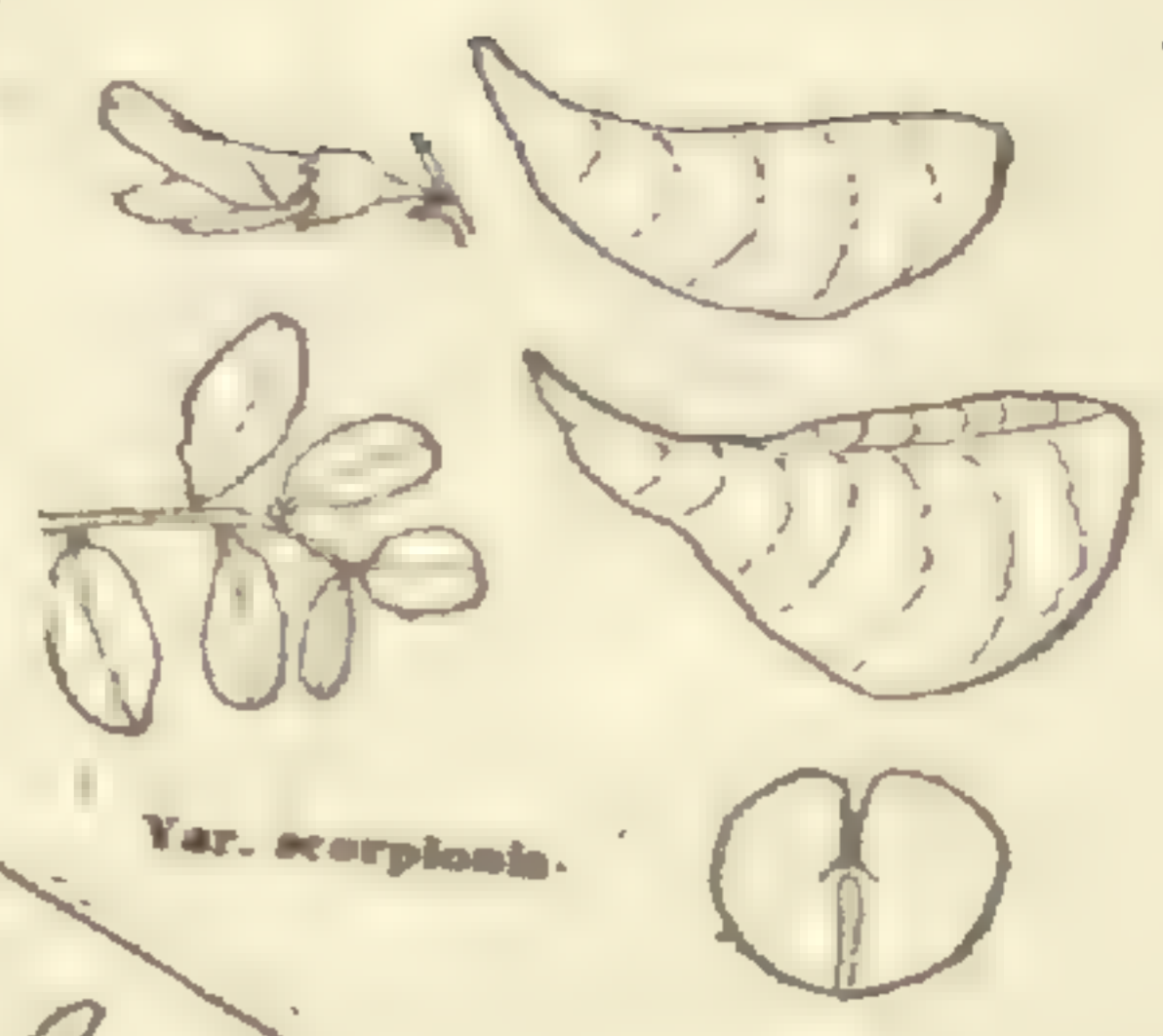
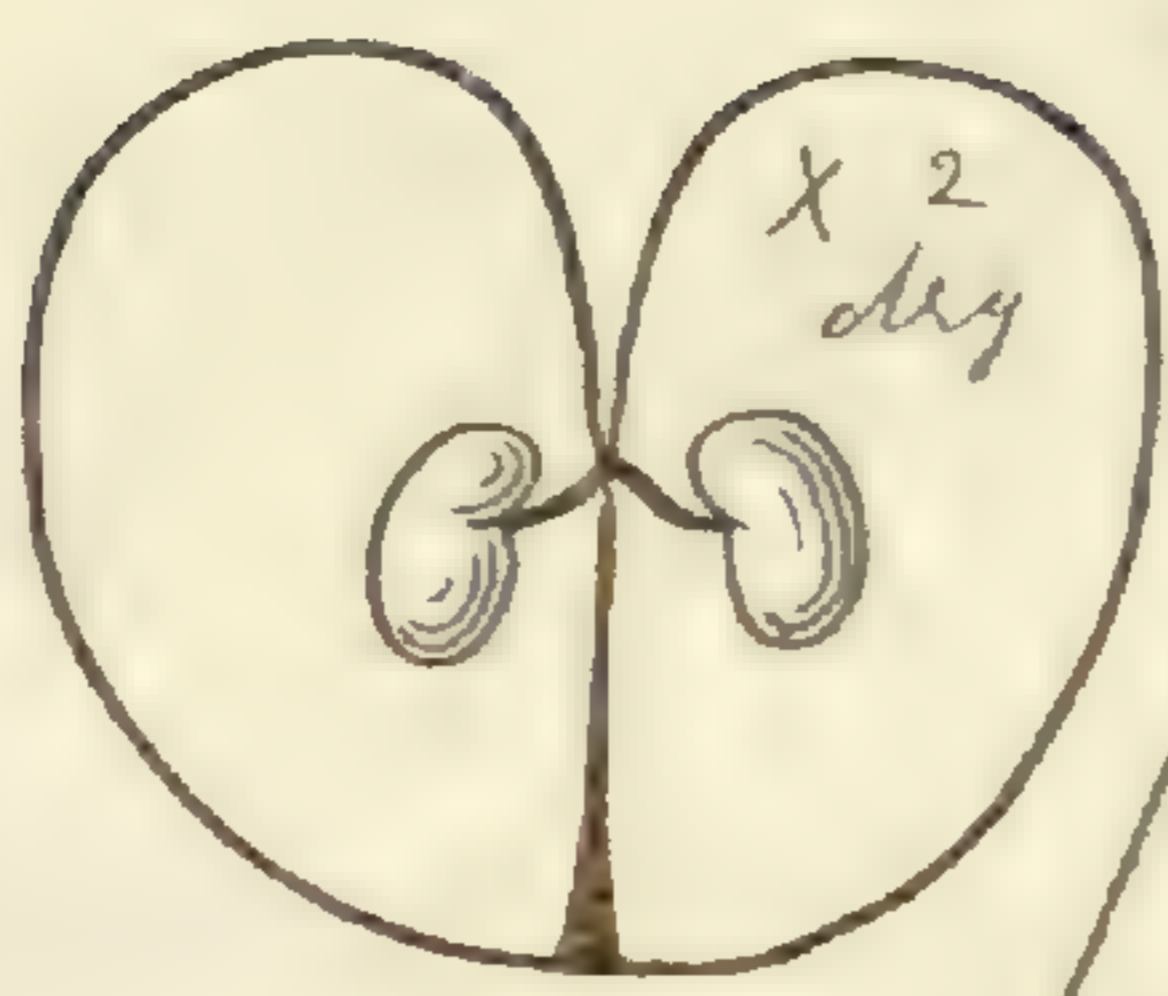
x 2 day
Var. *McDougall*



Var. *nigricalyca*



Var. nigricalyca



Var. scorpionis



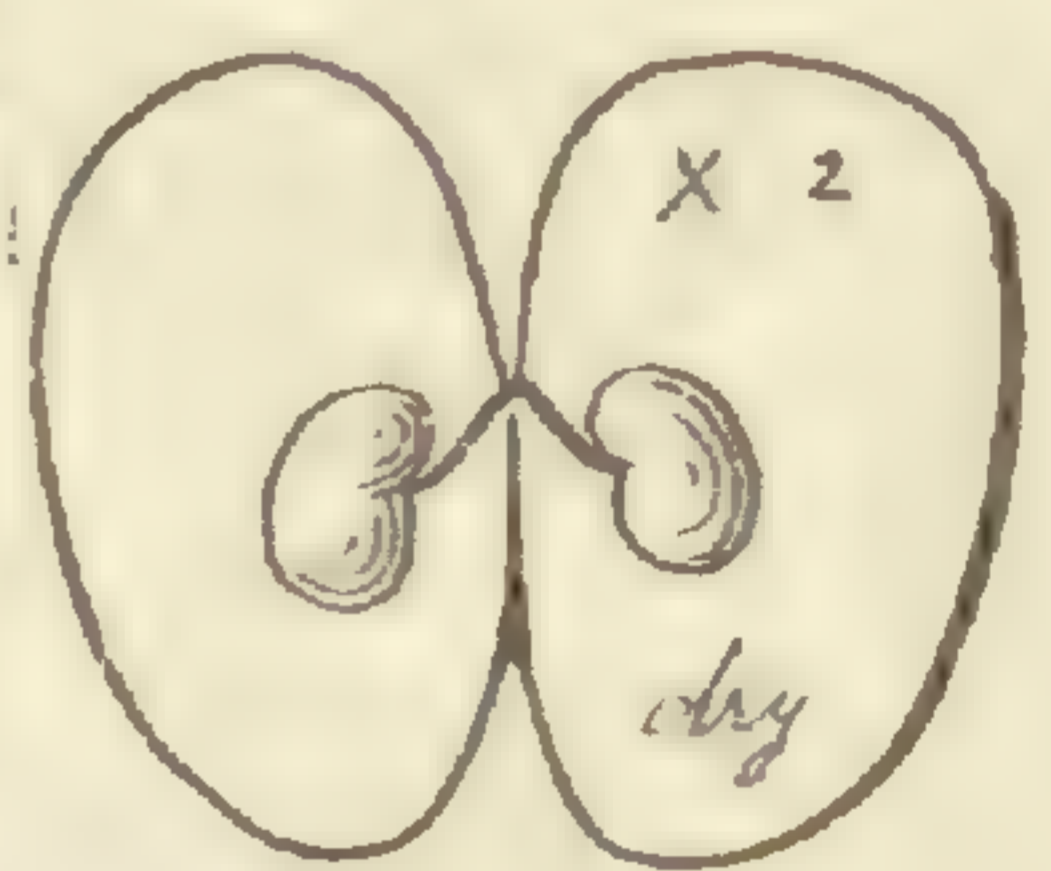
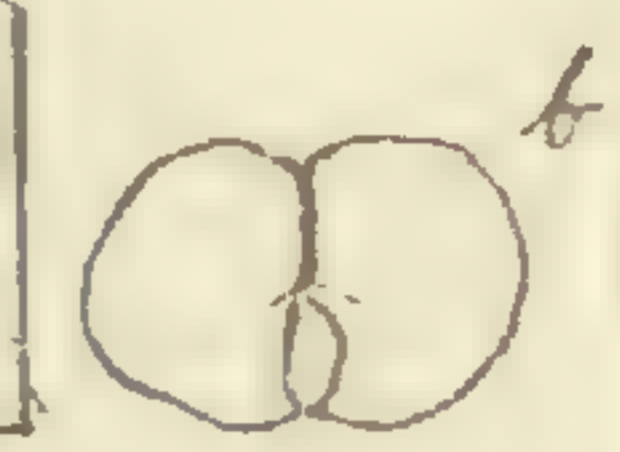
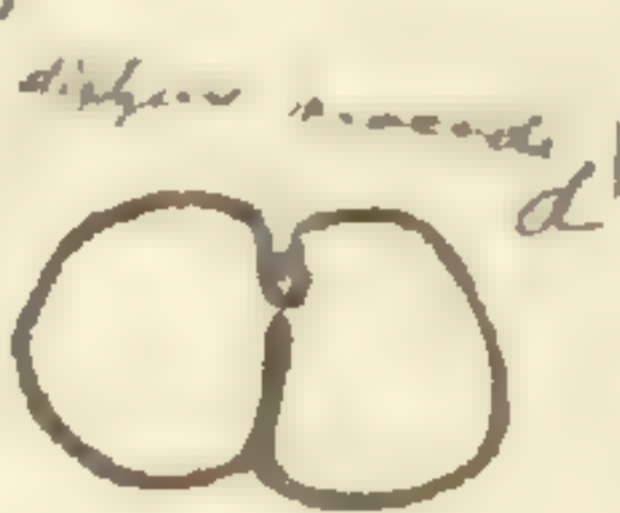
Var. carinatus



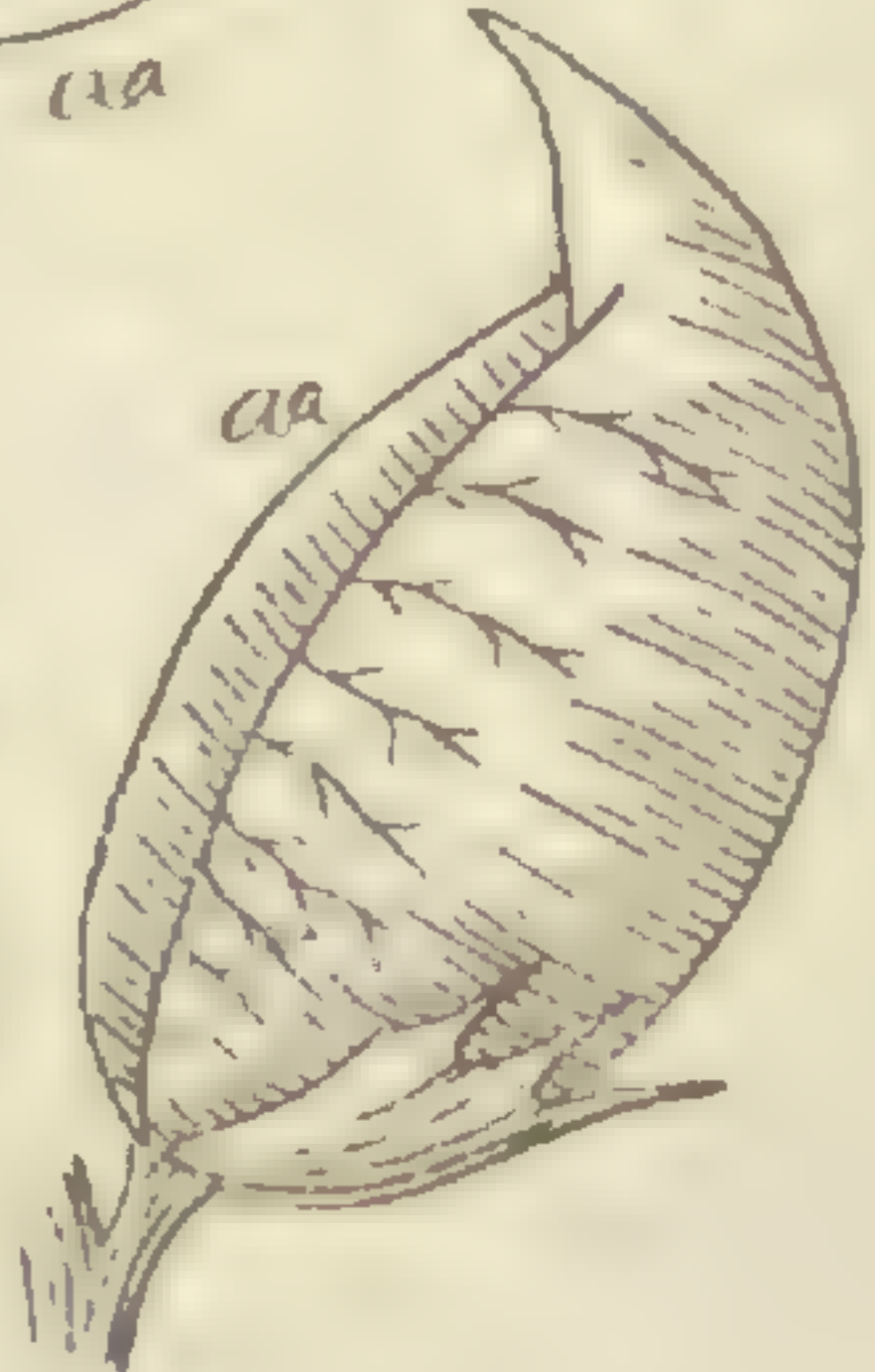
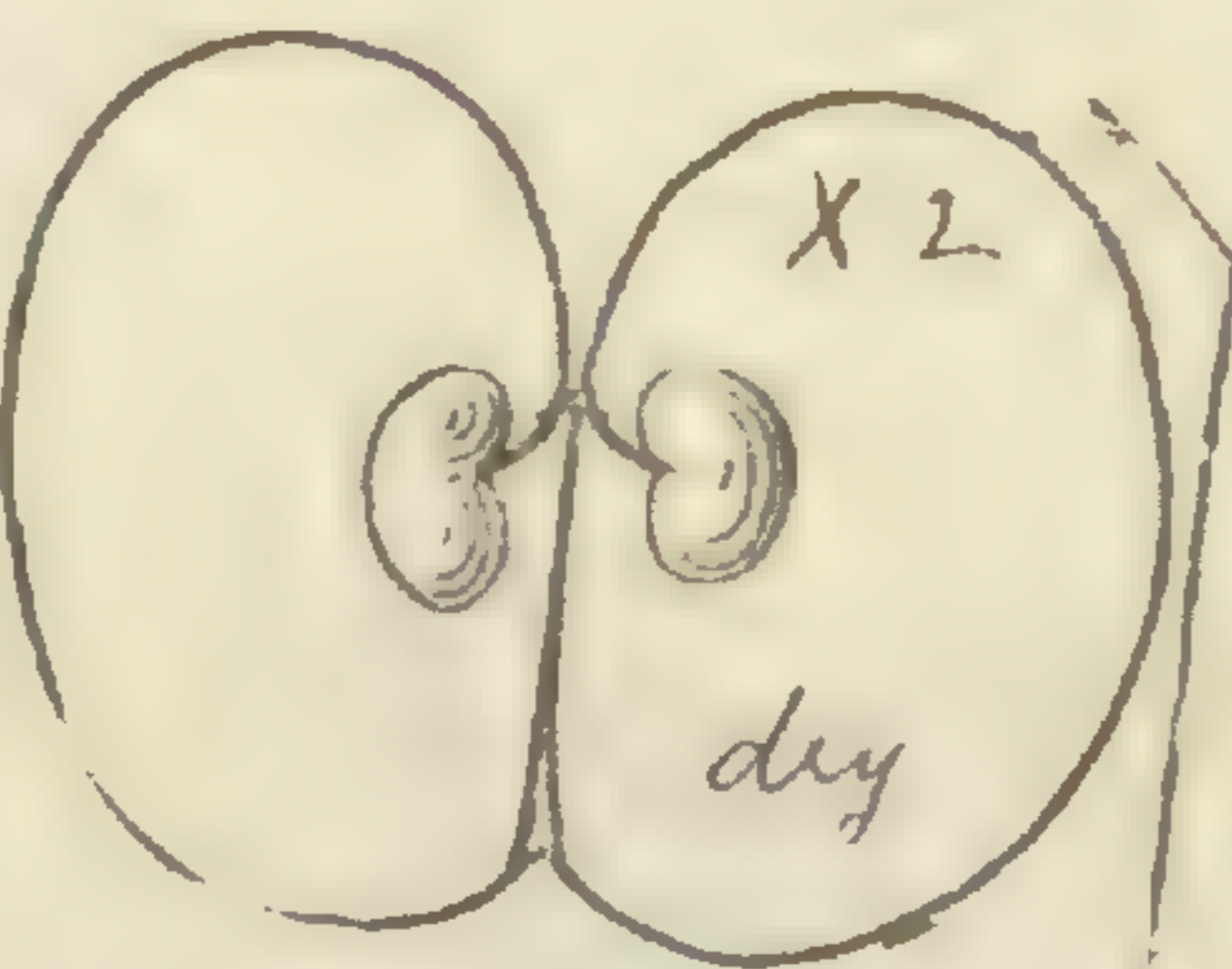
Var. diphyus

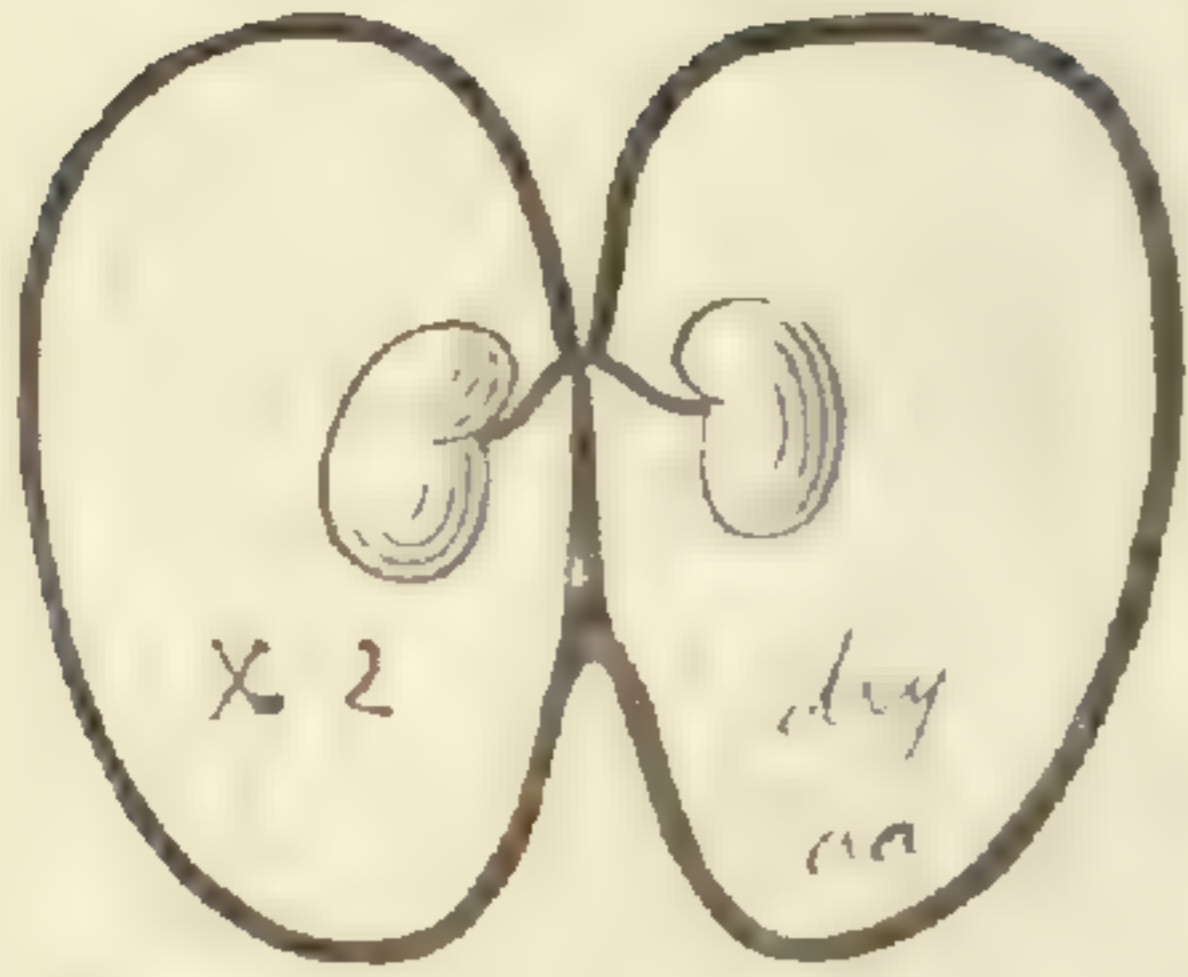


Var. latens

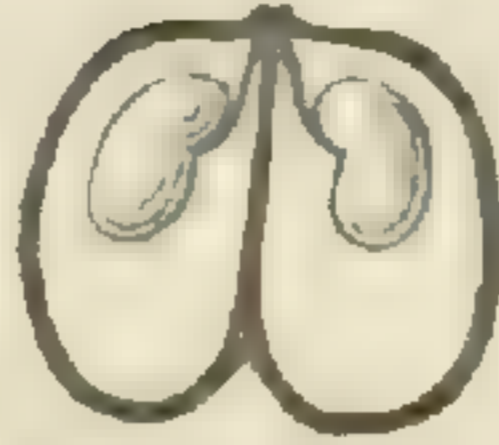


Var. latens





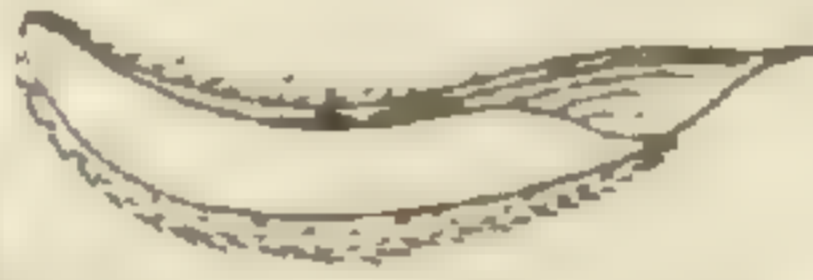
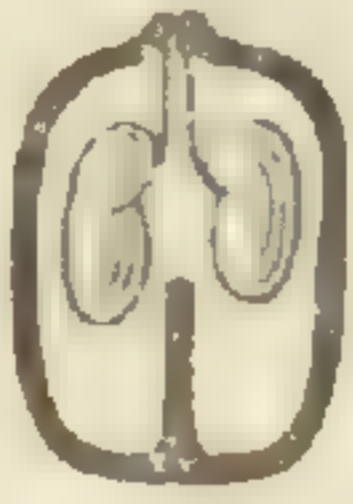
Var. *diphysus*



Var. *palau*



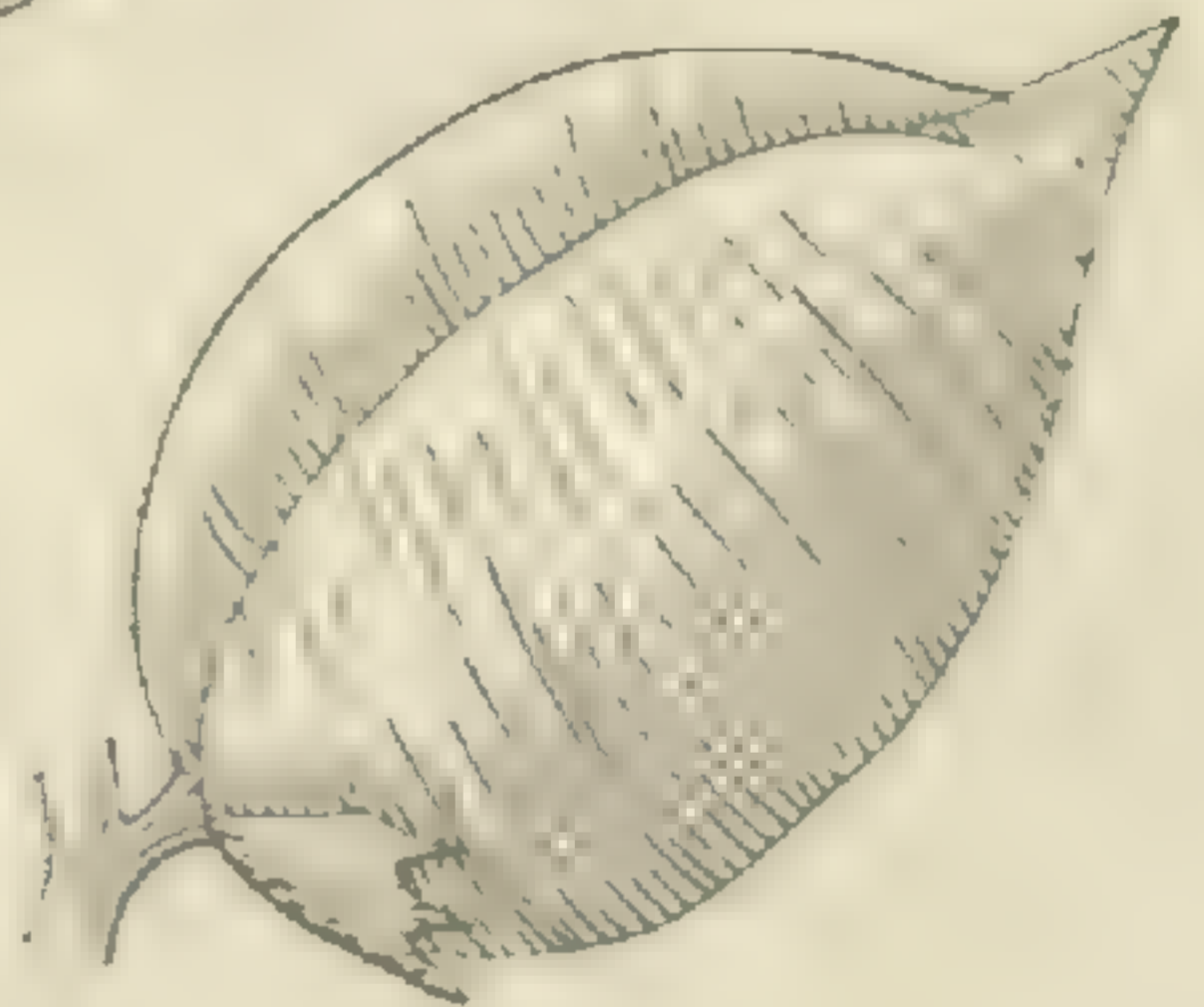
Var. *Makianensis*



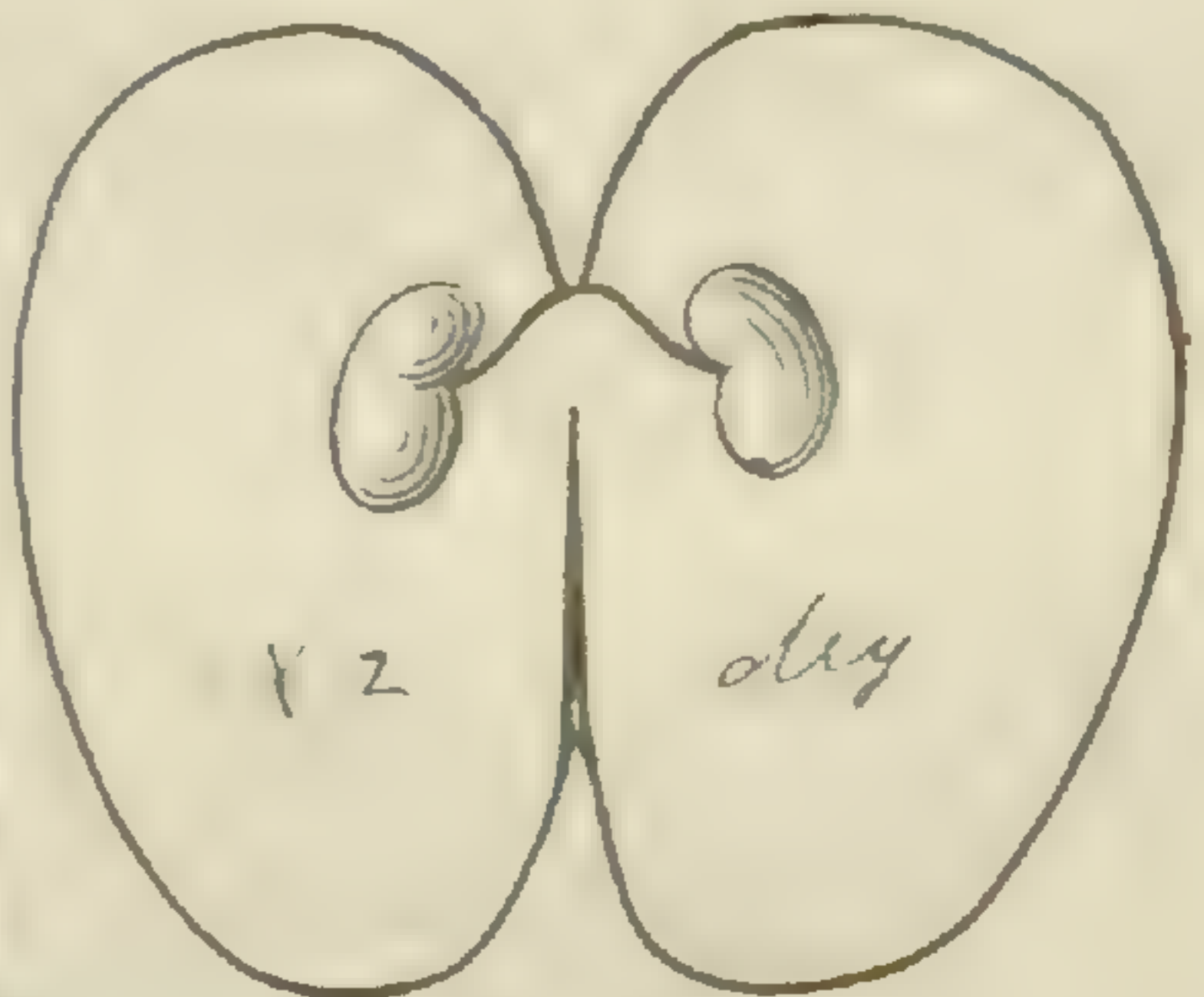
Var. *Borreganus*

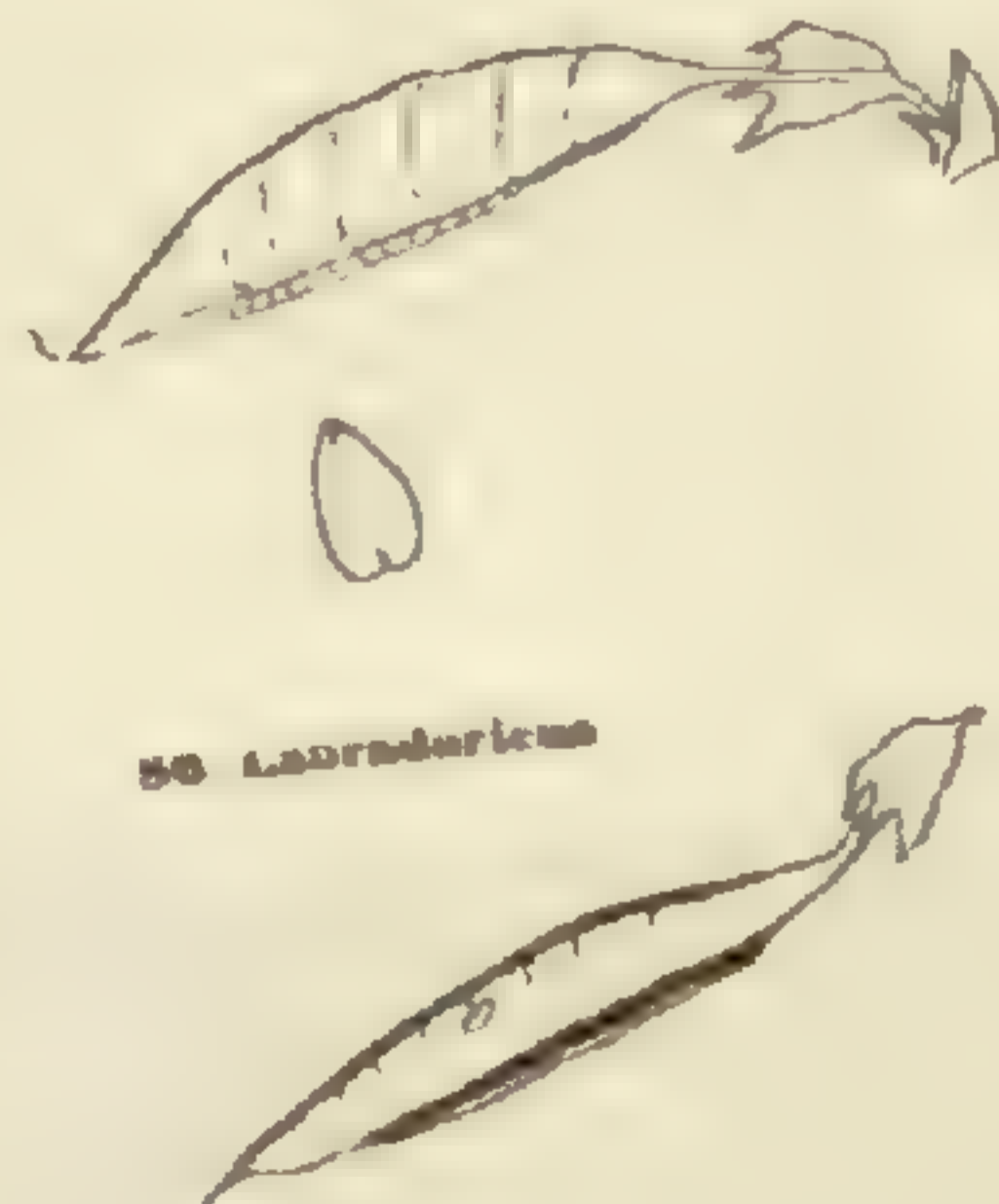
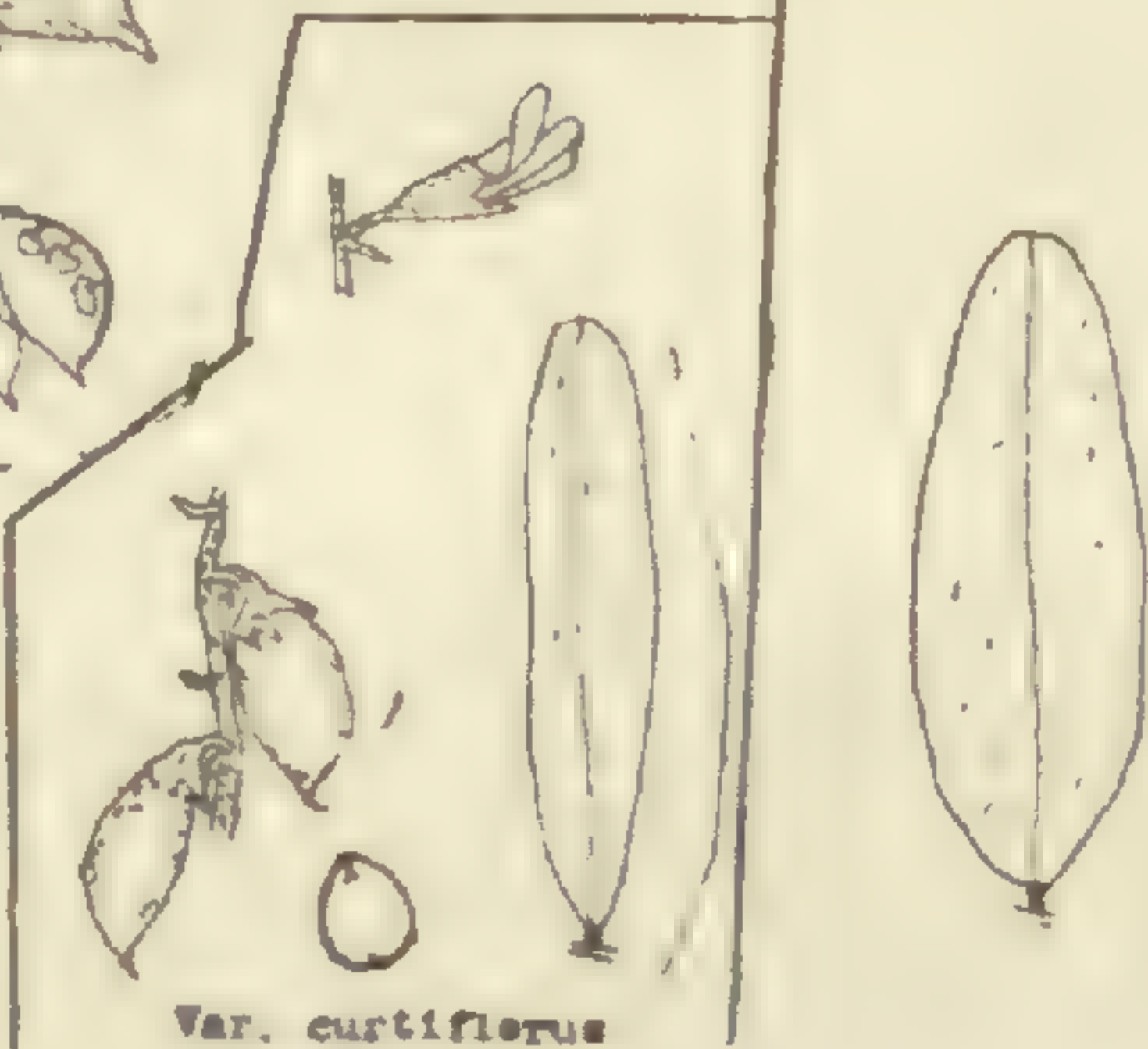
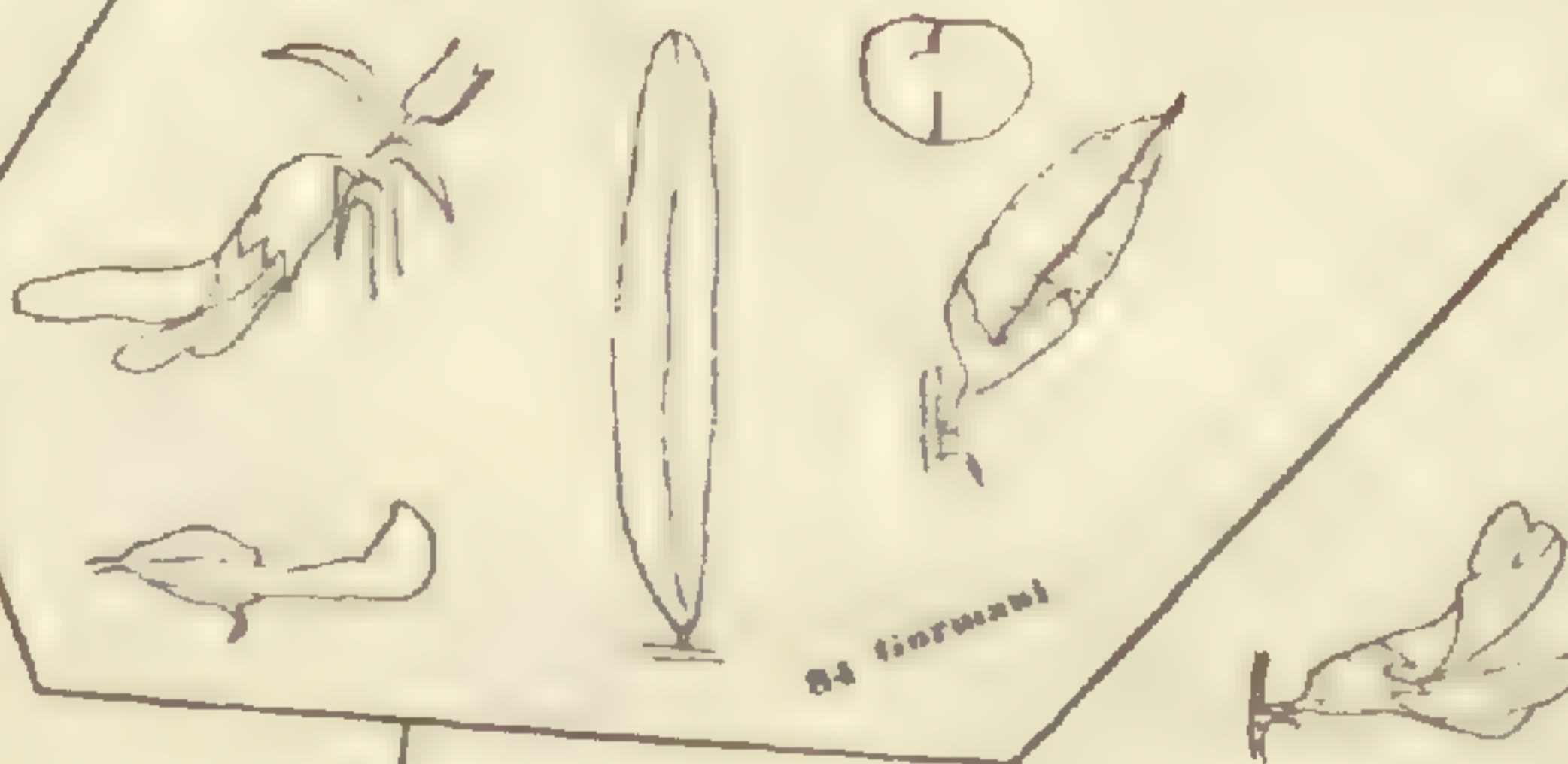
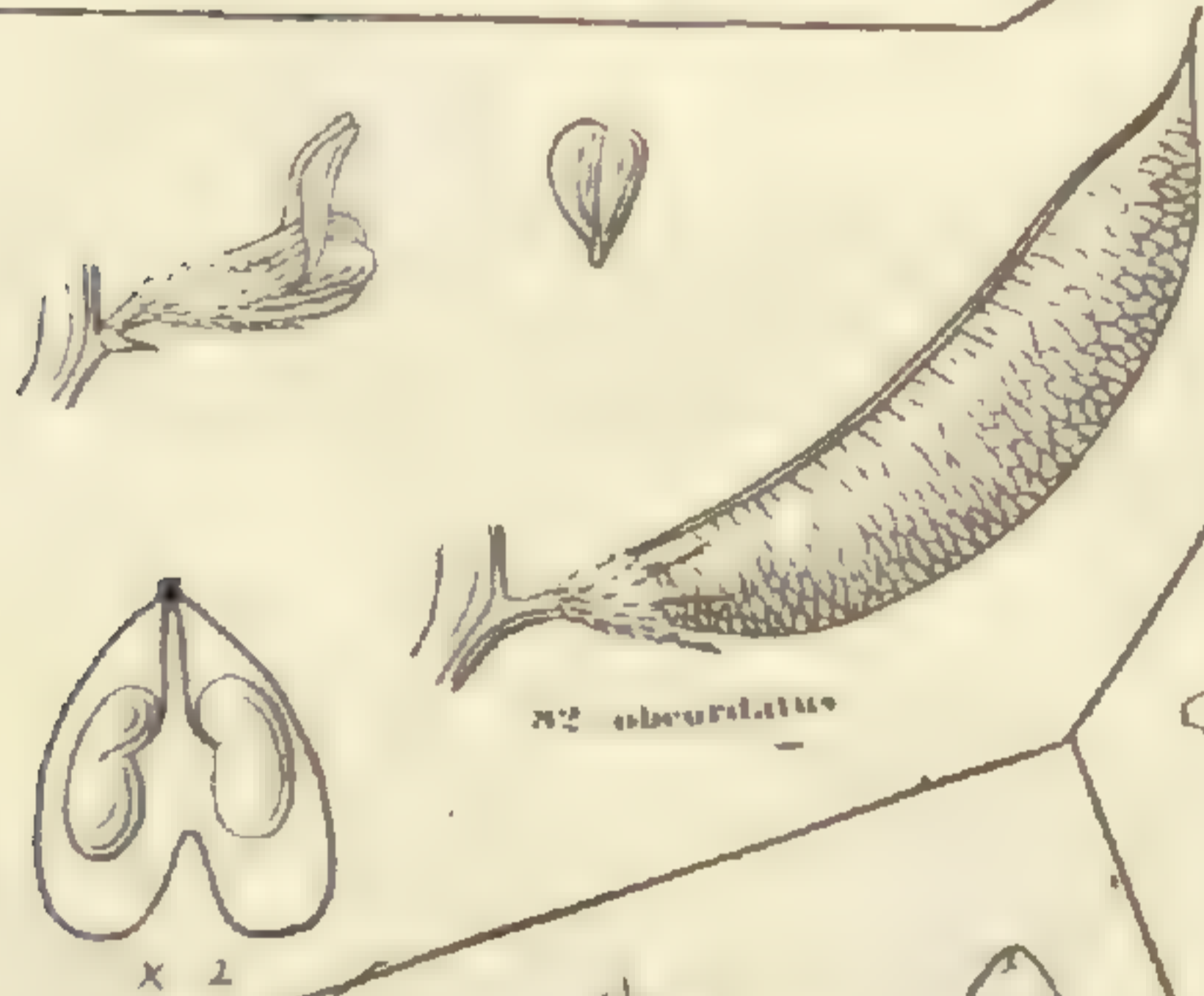


Var. *indica*



Var. *foemina*





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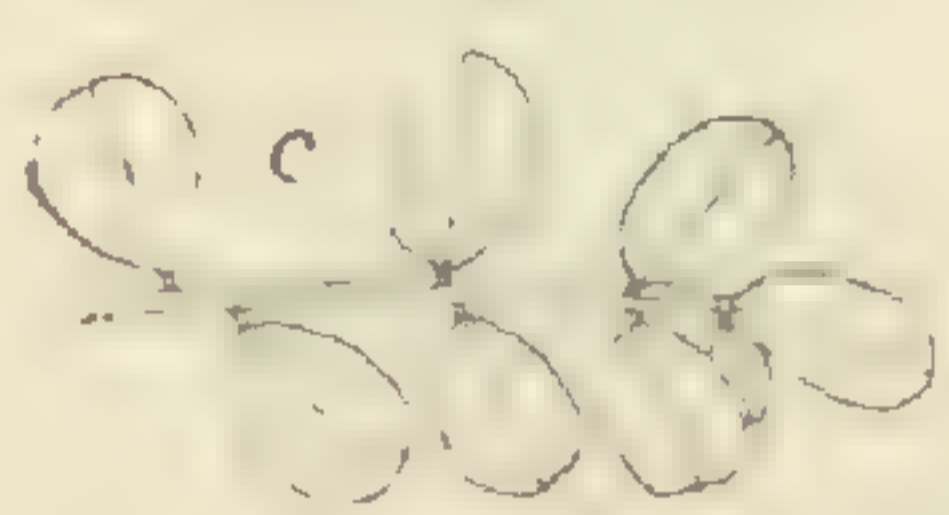
54 Labradoricus



Var. Holbliaff

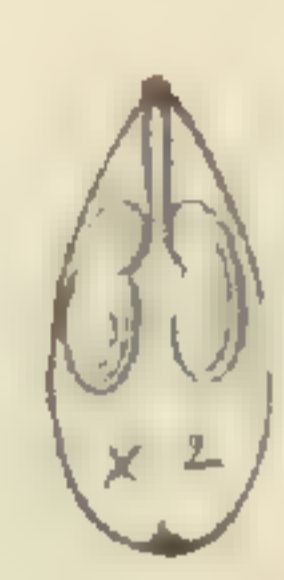
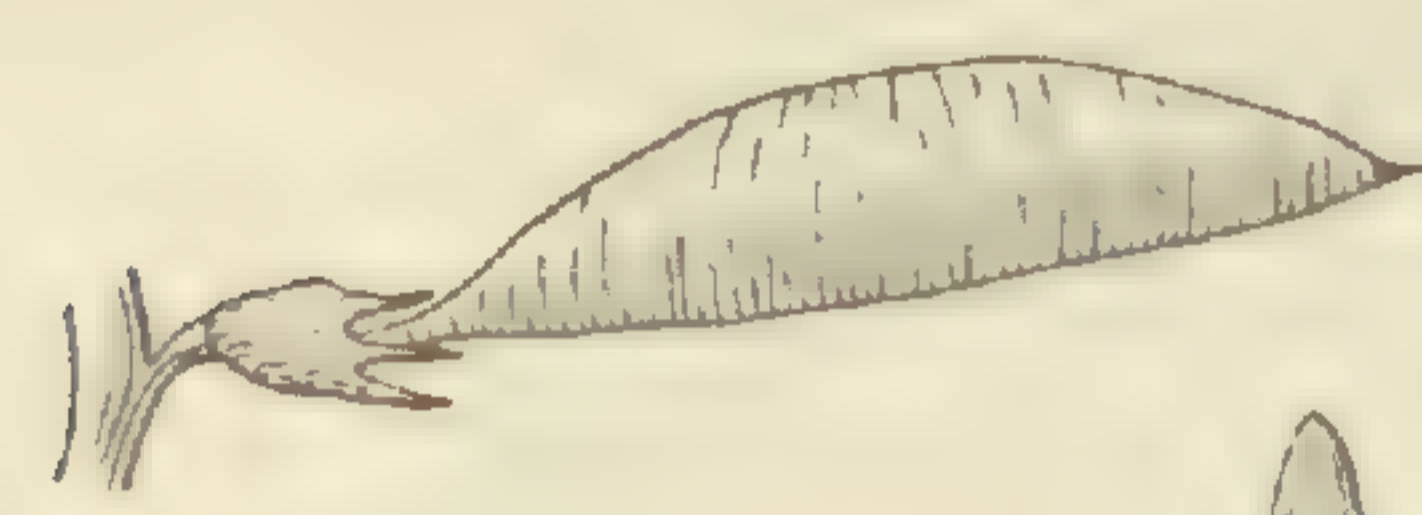


Var. bocksteinia



87 abrikium

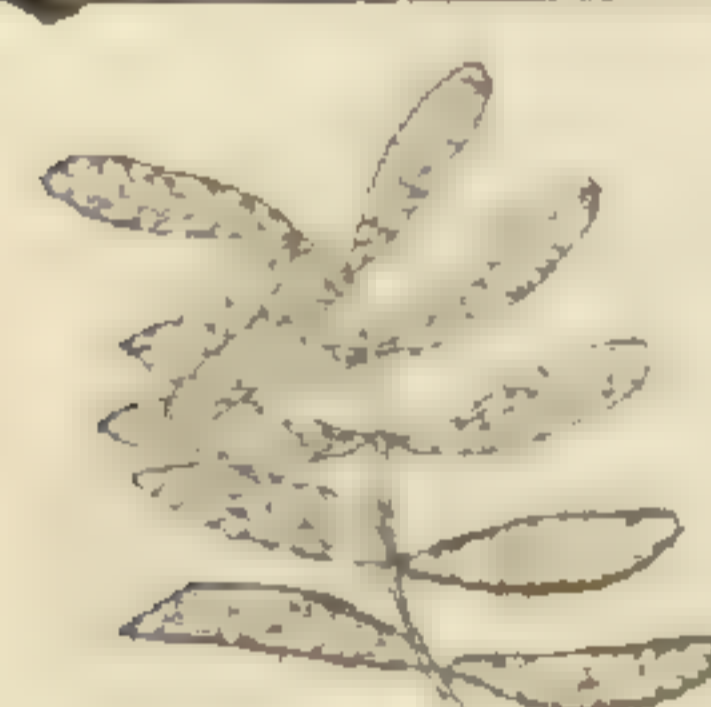
Var fastigiorum



Var. glabrescens



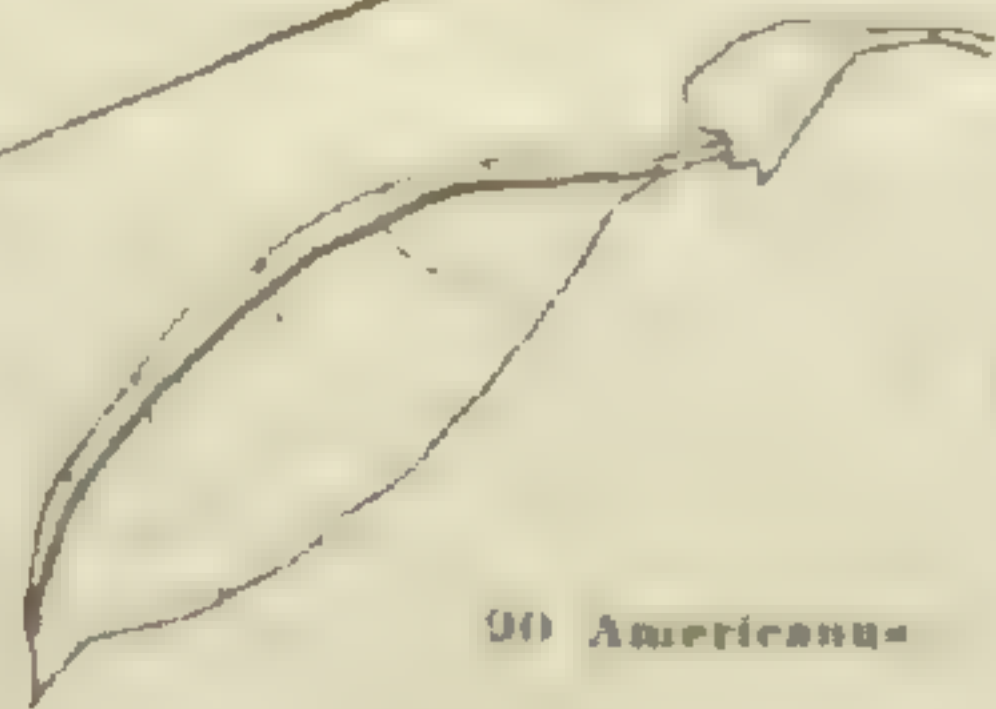
stem. fast



88 fulvum



89 alpinum



90 Americanum





91 andina

92 circumscissus

94 accumbens

93 Mahavenda

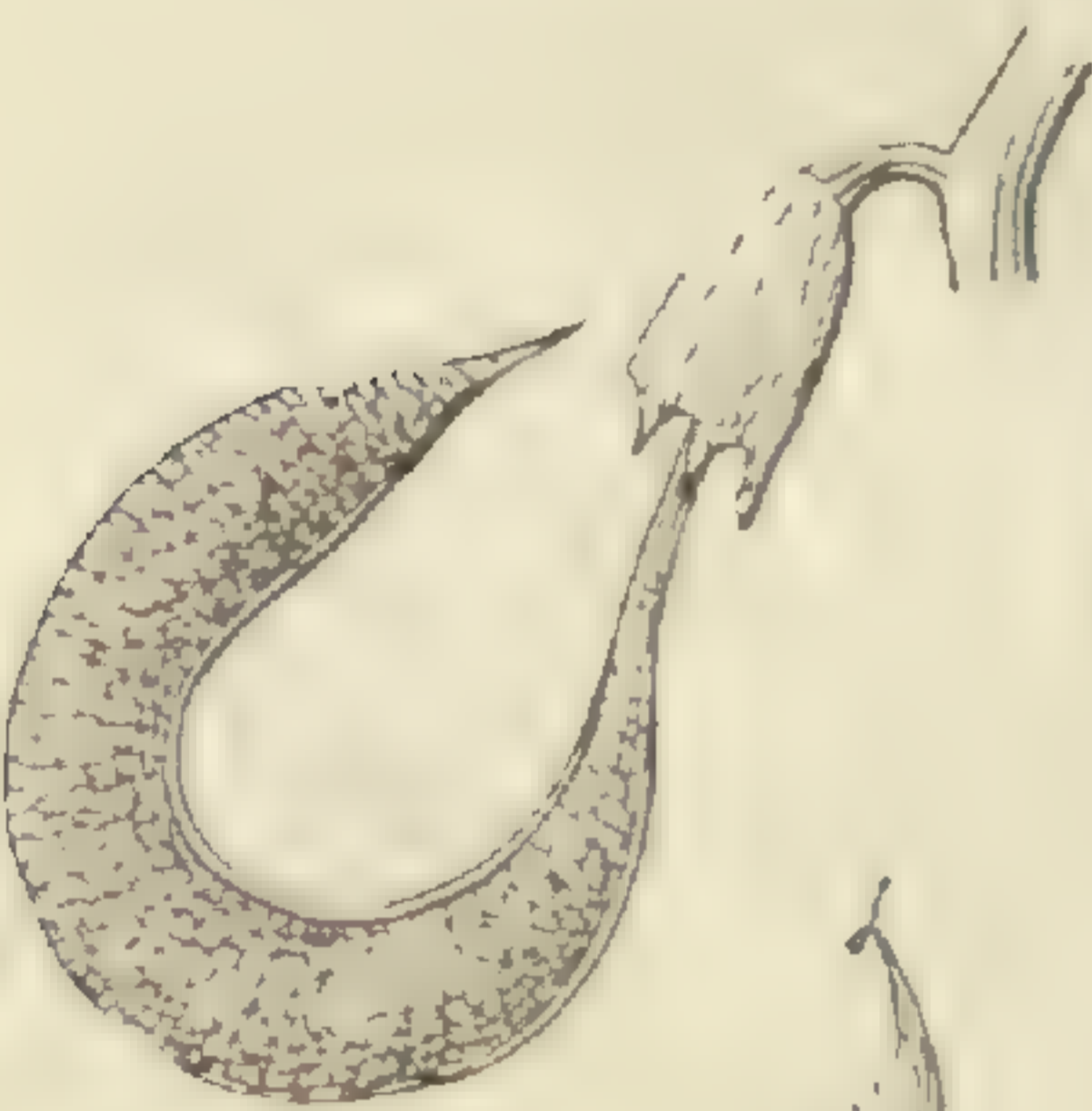
95 lotiflorus

96 Tweedyi

dry x 2
A. lotiflorus var.
Reverchonii

97 collina

(29)



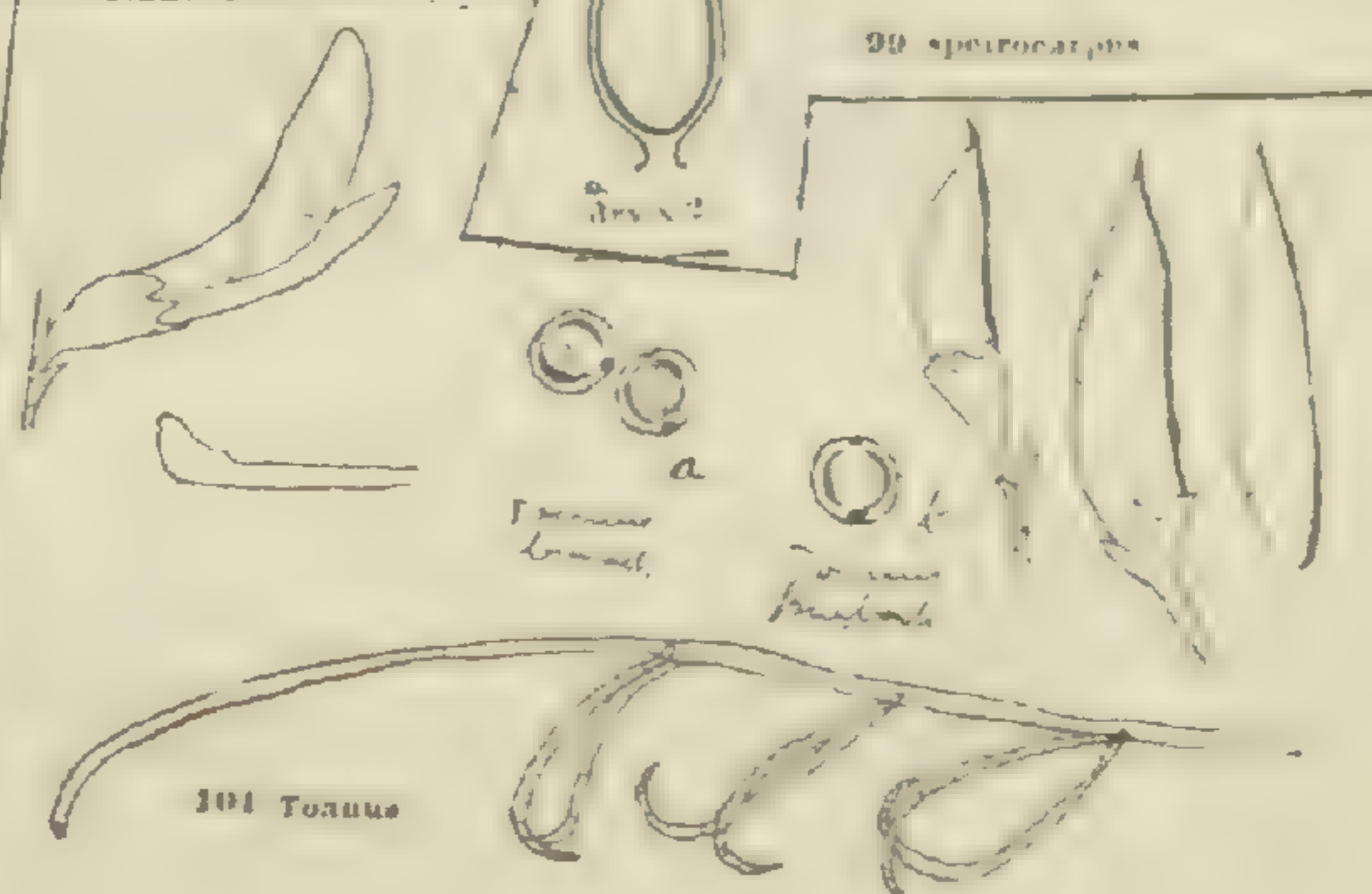
98 Gibbifolium



99 spectabile



100 Alfordensis



101 Toanus

(30)

102 Rafalefista

103 Grayl



dry x 2

fresh x 2

104 pectinatus

105 Cunei



V.1. tonilis var. platypyllus

16



100 *pterocarpus*



107 *trilobatus*



pterocarpus to the south.



Var. *Capricornus*



109 *bicristatus*

108 *macrocarpus*



macrocarpus



dry 2

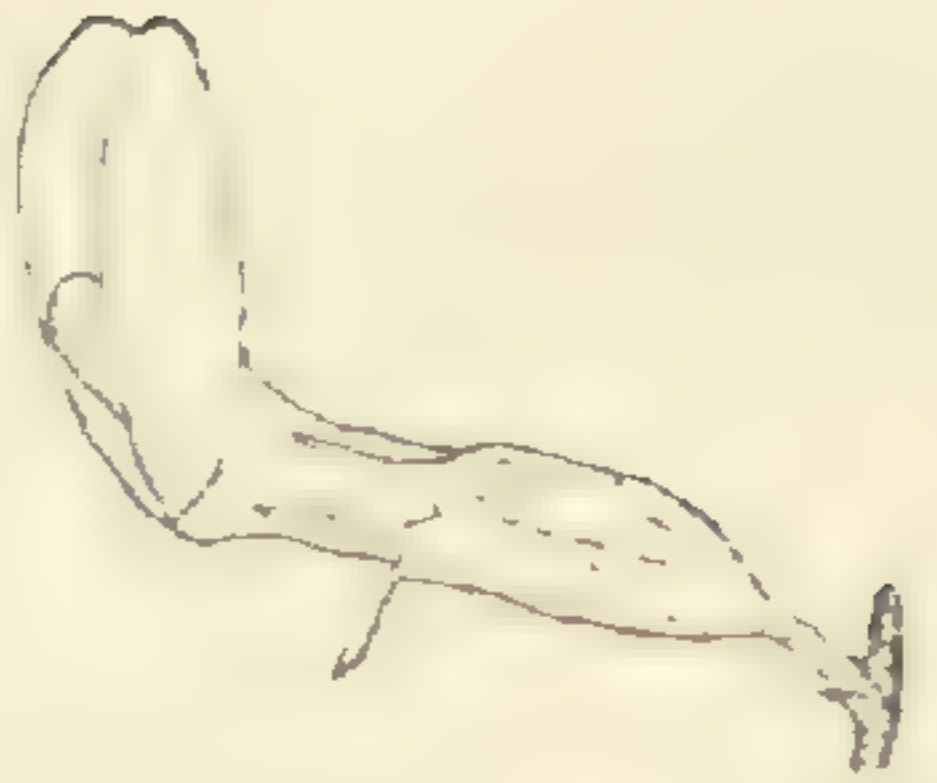
(32)



dry x 2
A. bicristatus var
tetrapteroides



110 Serouol



111 canalis



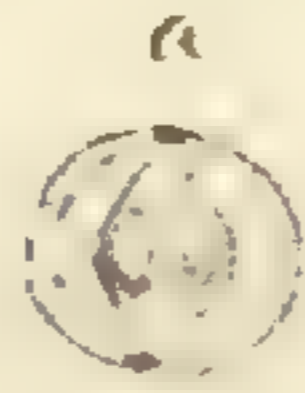
a



dry x 2



Wrightian
Kochii



b

112 pachypus

113 Fremali

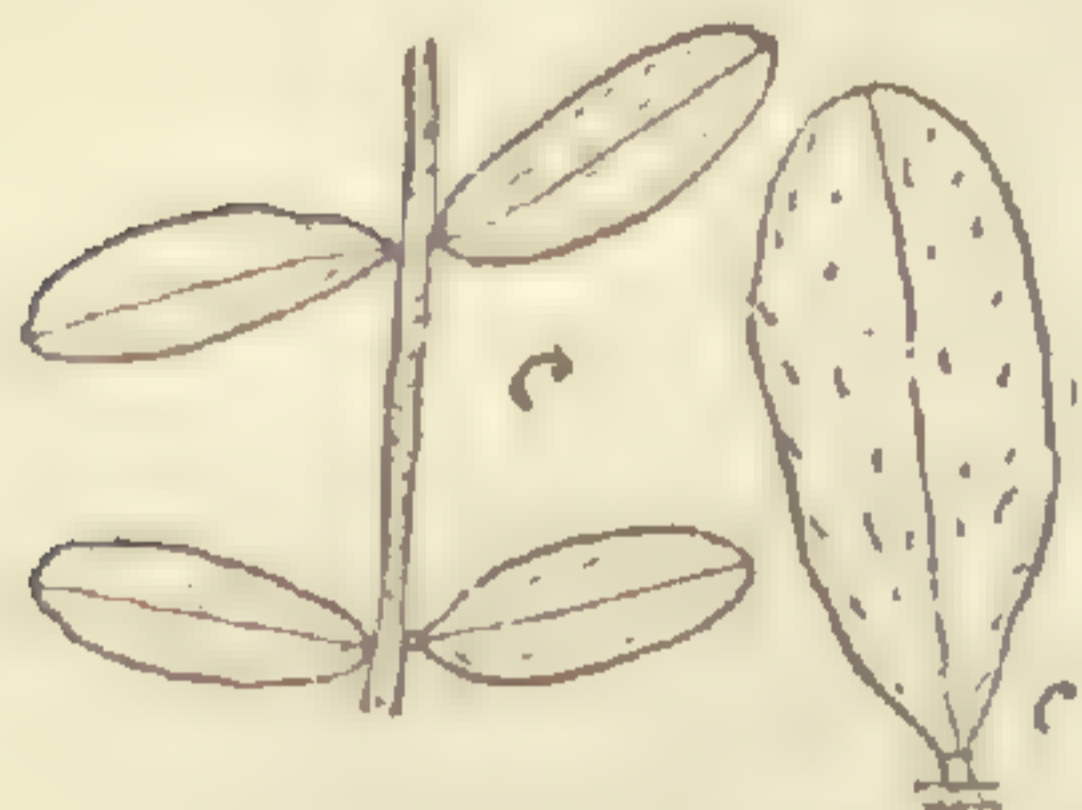
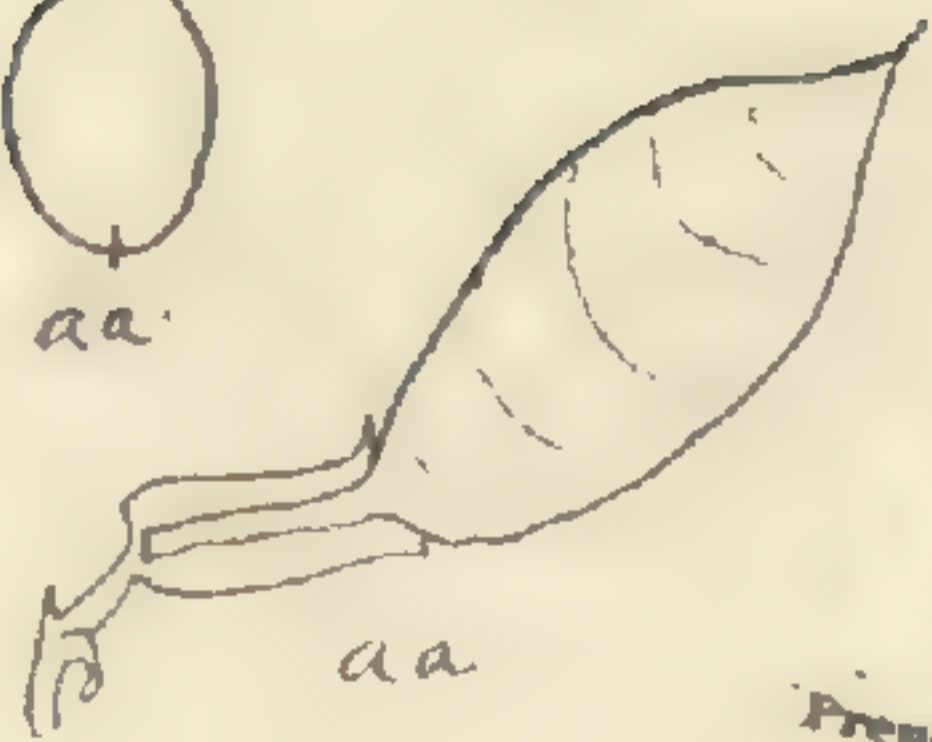


Plum
Kochii

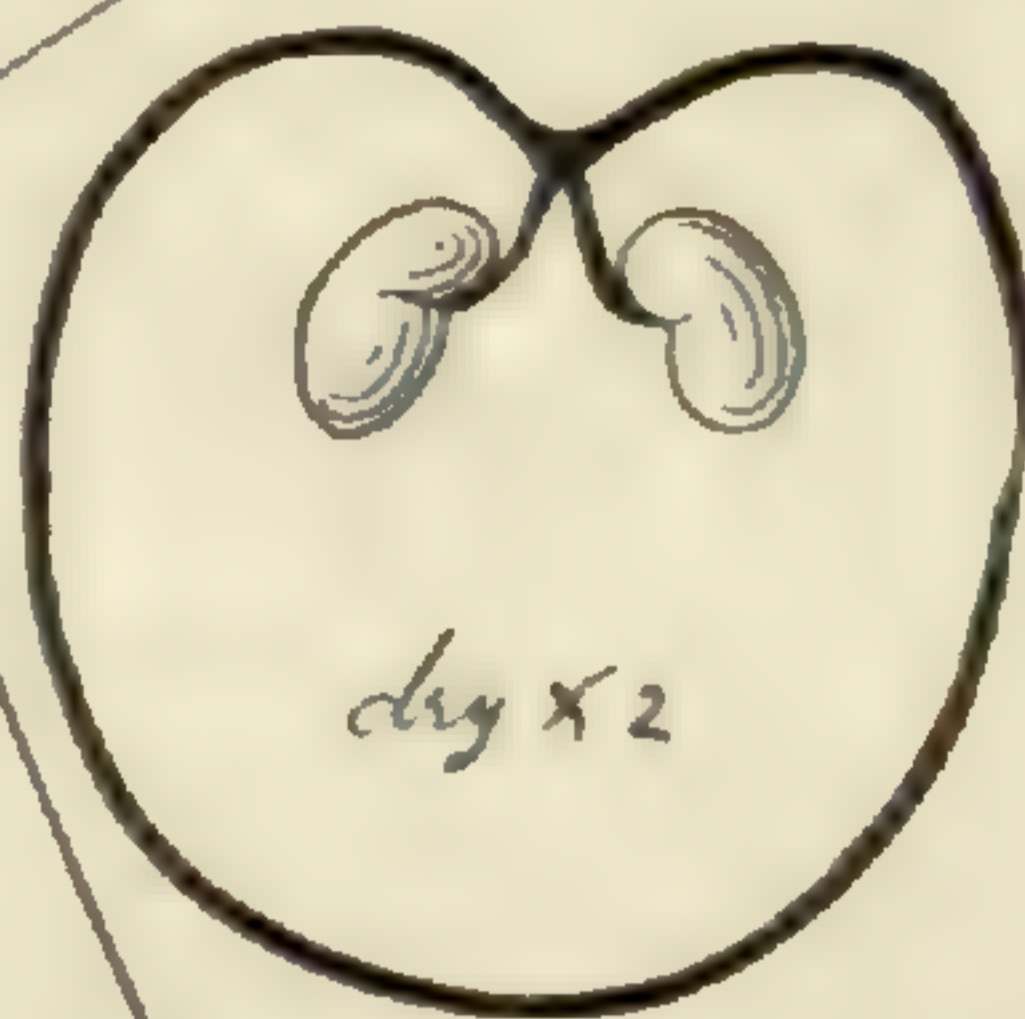


a





114 *arbutarius*



Var. Eastwoods



Eastwoods



115 *hematoc*



(34)

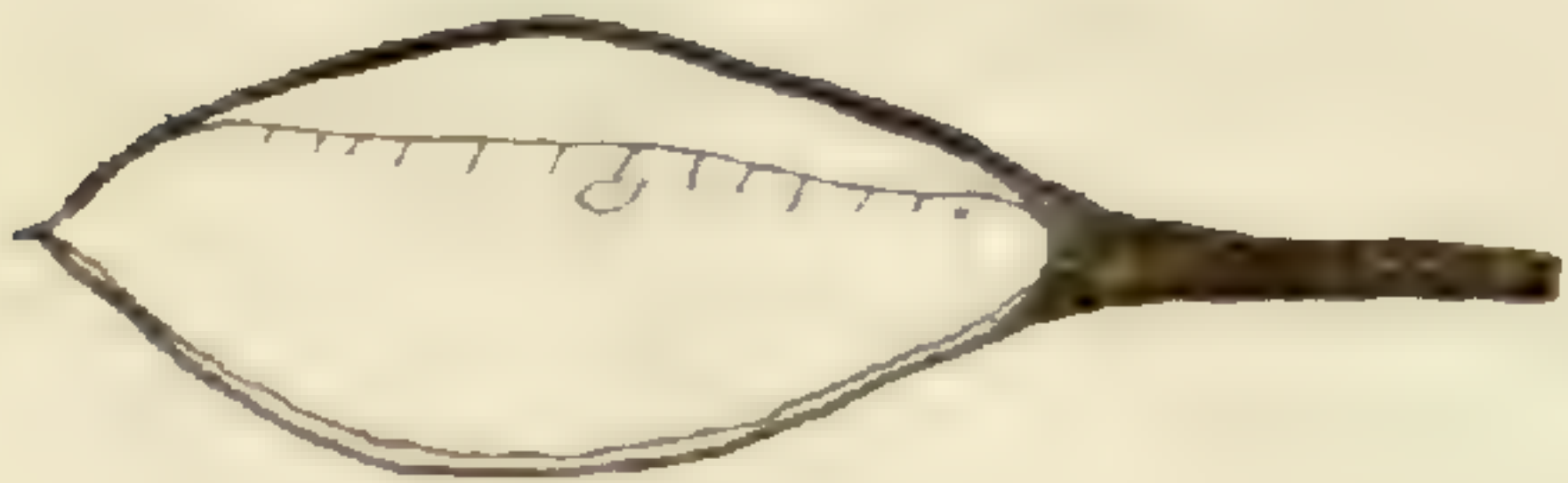


115

84 elegans, var. rufiflorus



116 aclepladoides



accladodes



! 361



Lebena pumila



116 *subulosa*



119 *revertus*

A. revertus var. *conjuncta*



A. revertus var.

subulosa

dry x 24



dry x 2

A. revertus var. *pumila*



dry x 24



a

a

dry x 24

A. revertus var. *conjuncta*



a



a



a



120 adanus



dry x 2



121 arrectus

A. atropubescens

A. arrectus var. Palousensis



dry x 2



dry x 2

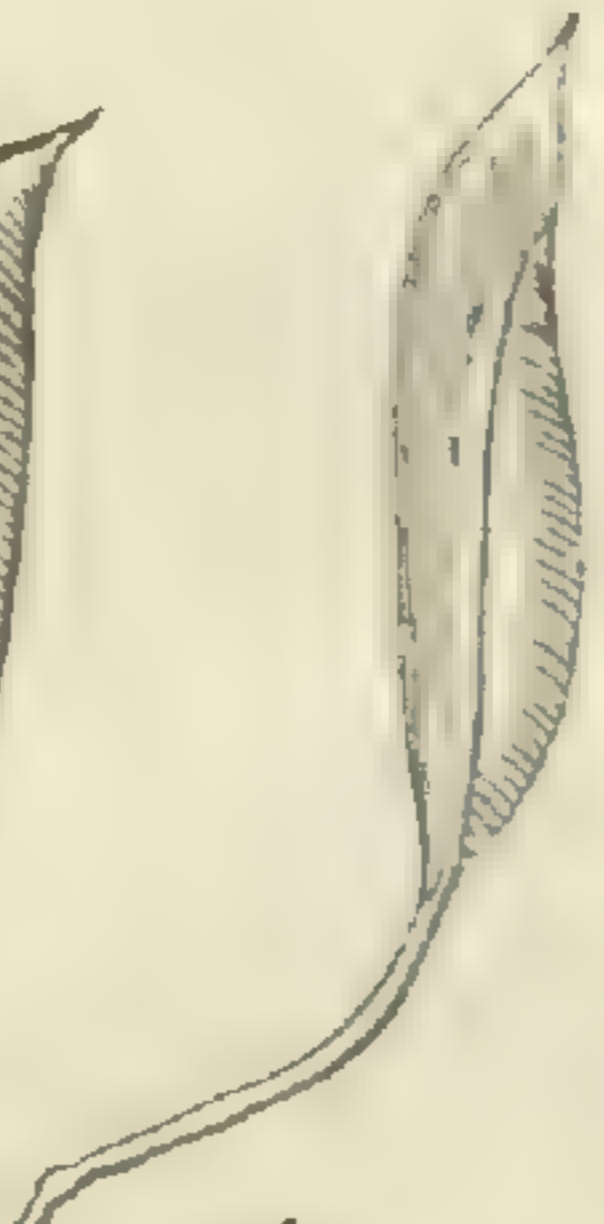


arrectus
hirsutus



a

A. arrectus var. Leibergi



dry x 2

A. Malheurensis



a



dry x 2 L



Var. eremiticum



dry x 2



sect. fur. +
montan.



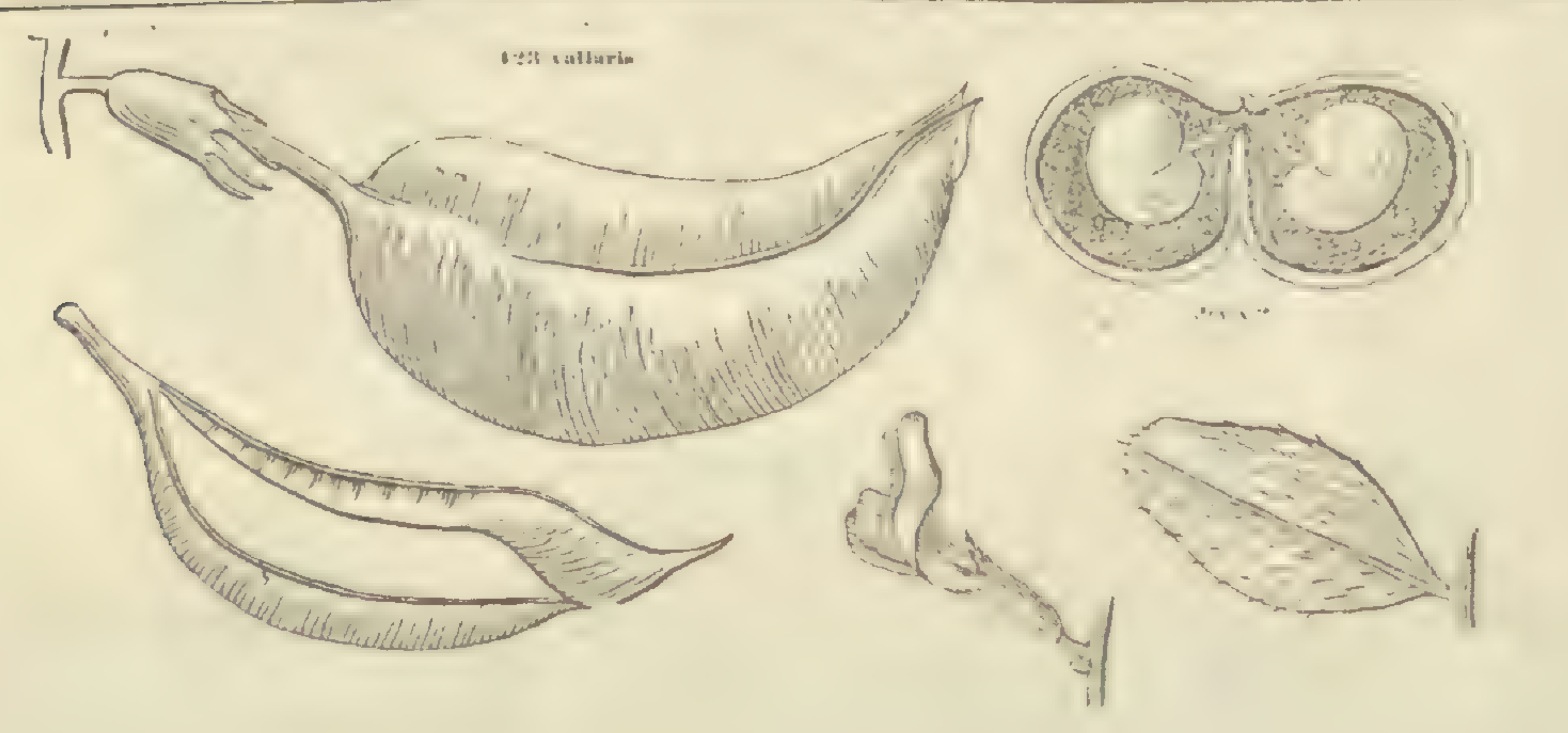
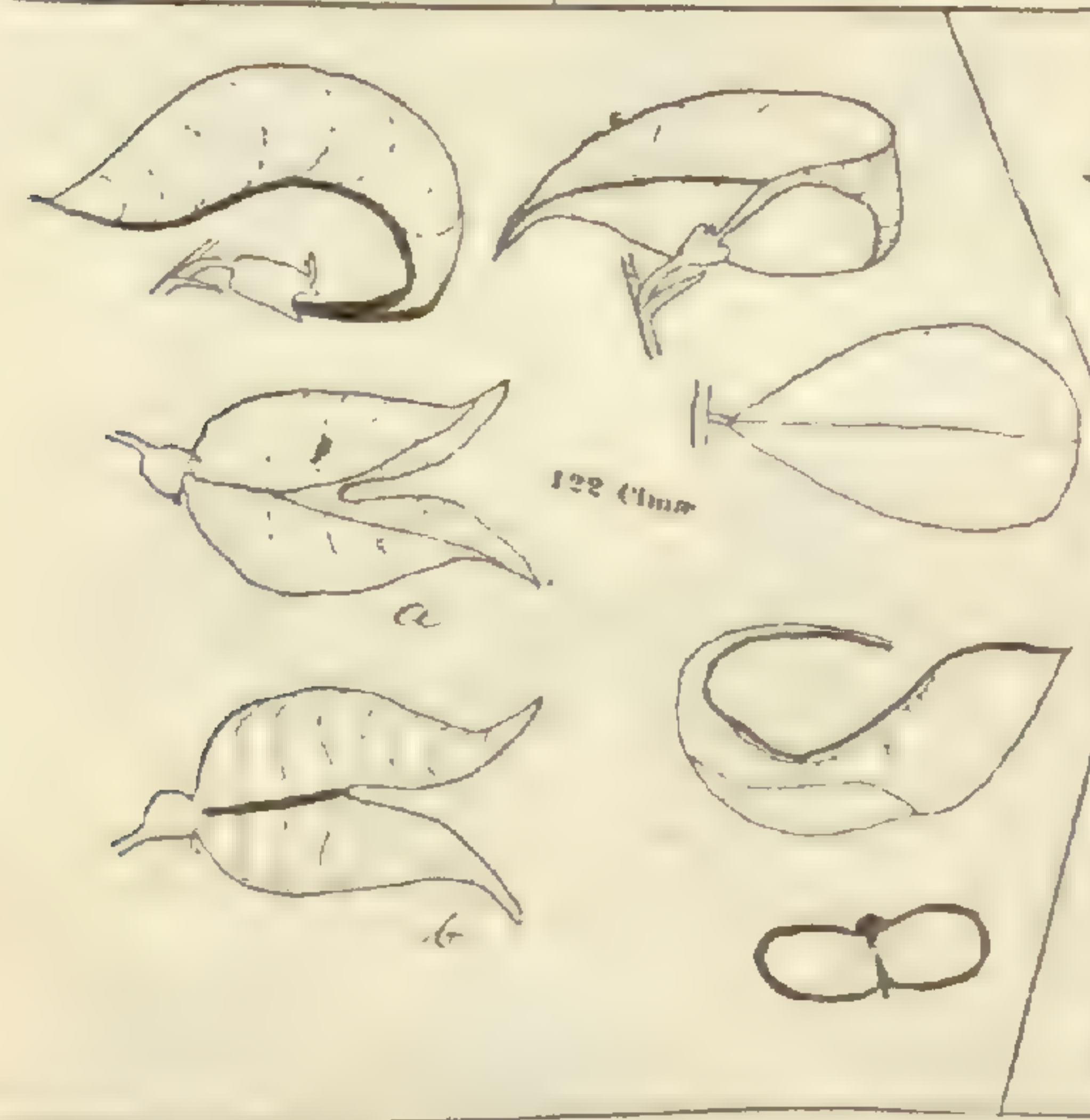
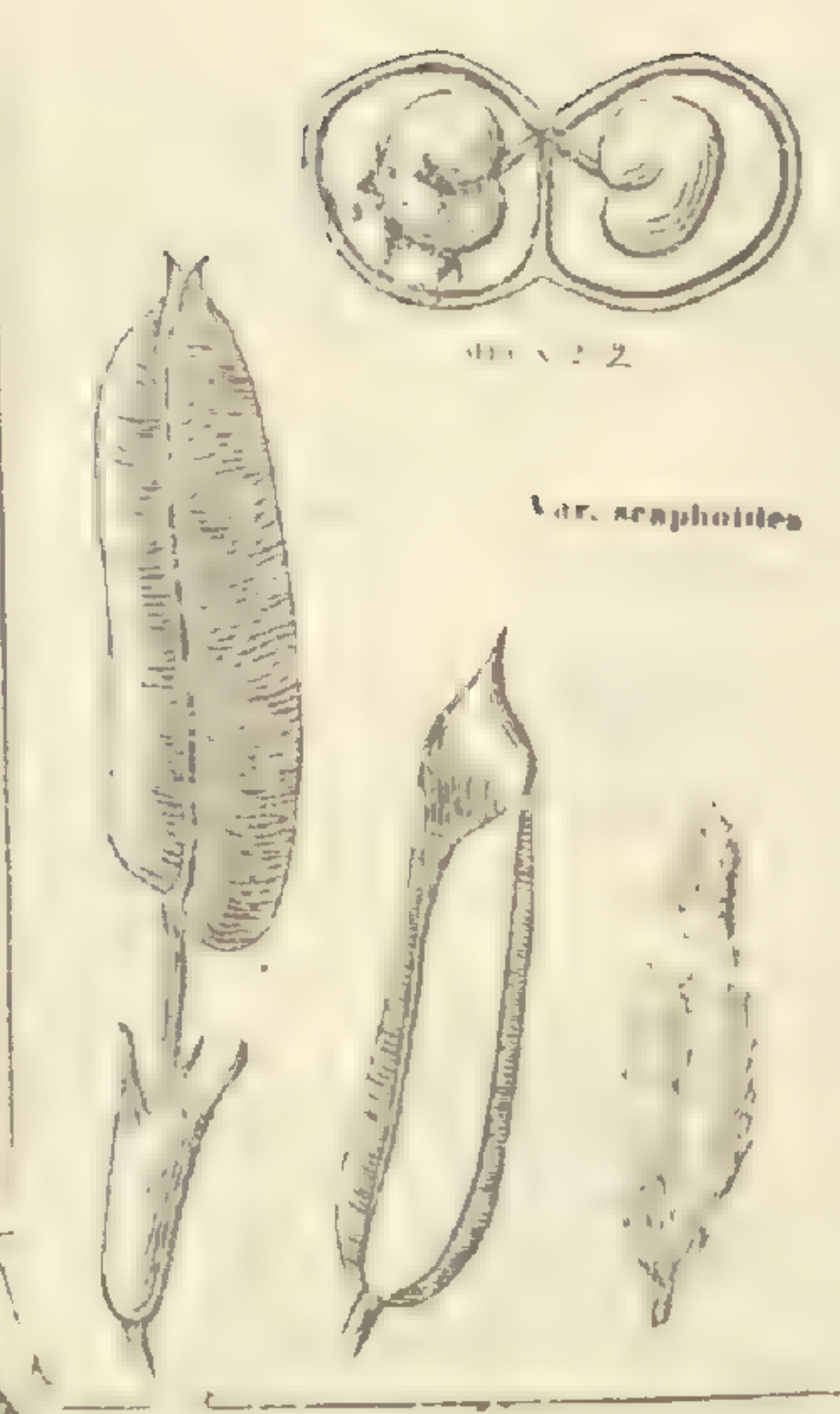
a

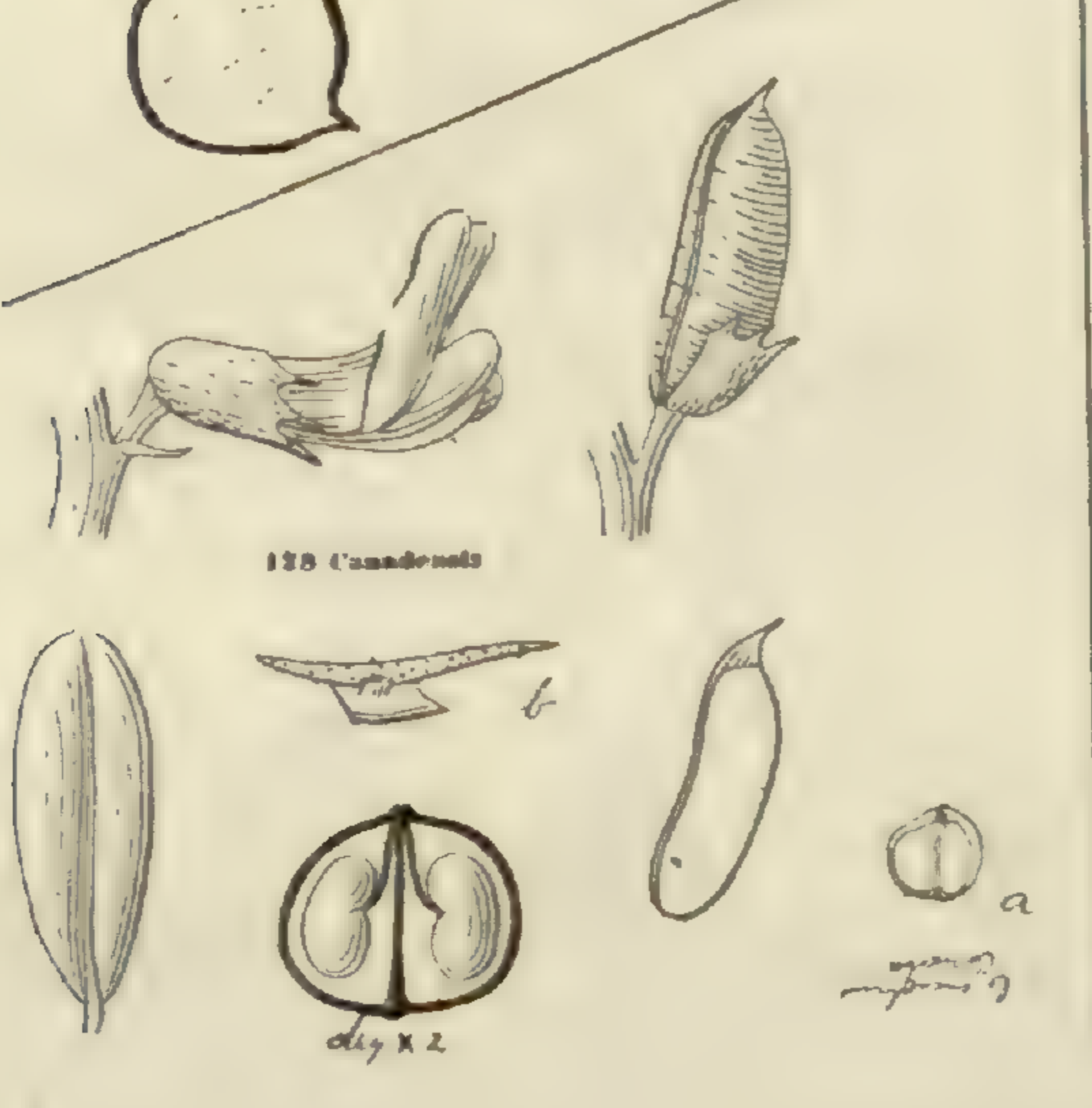
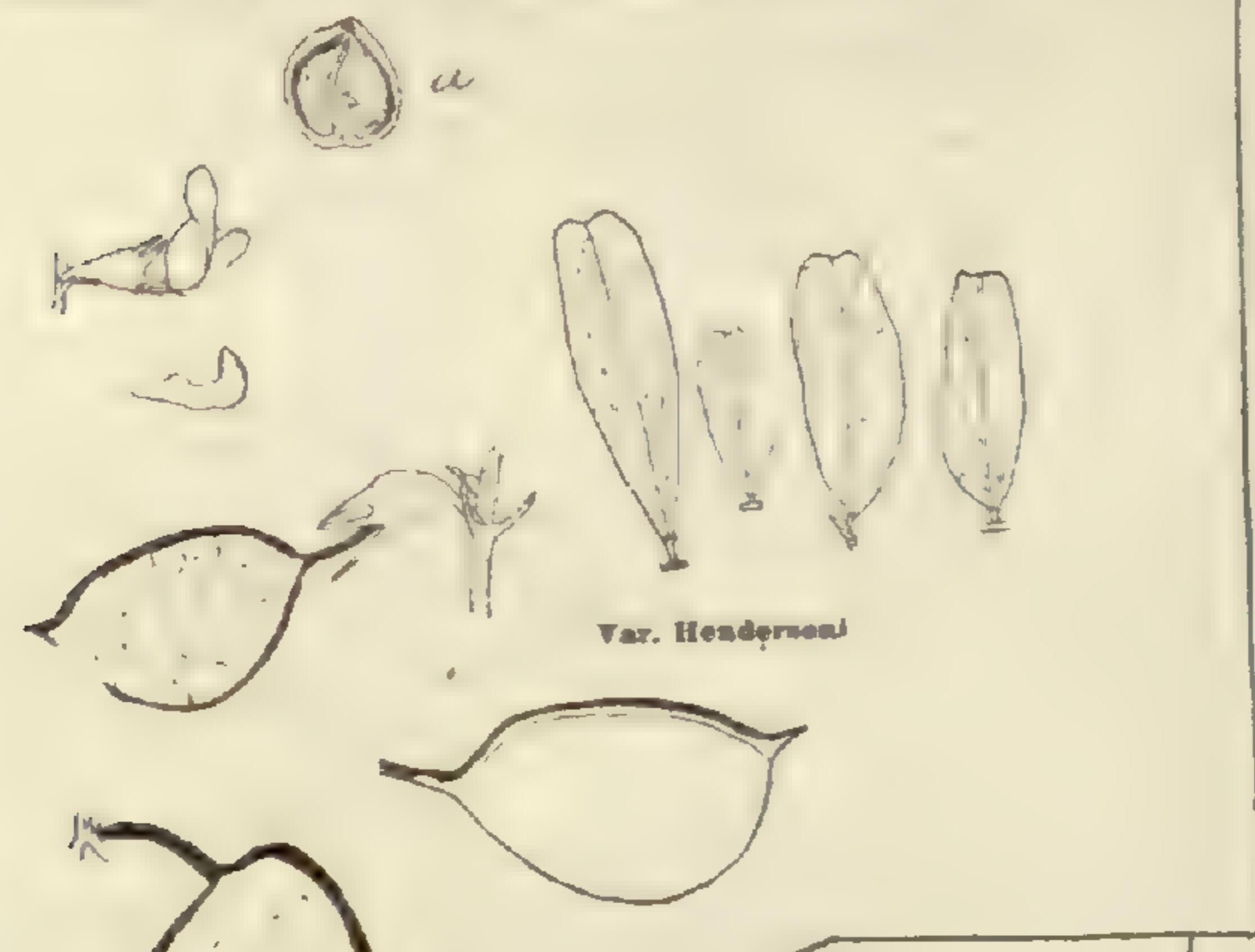
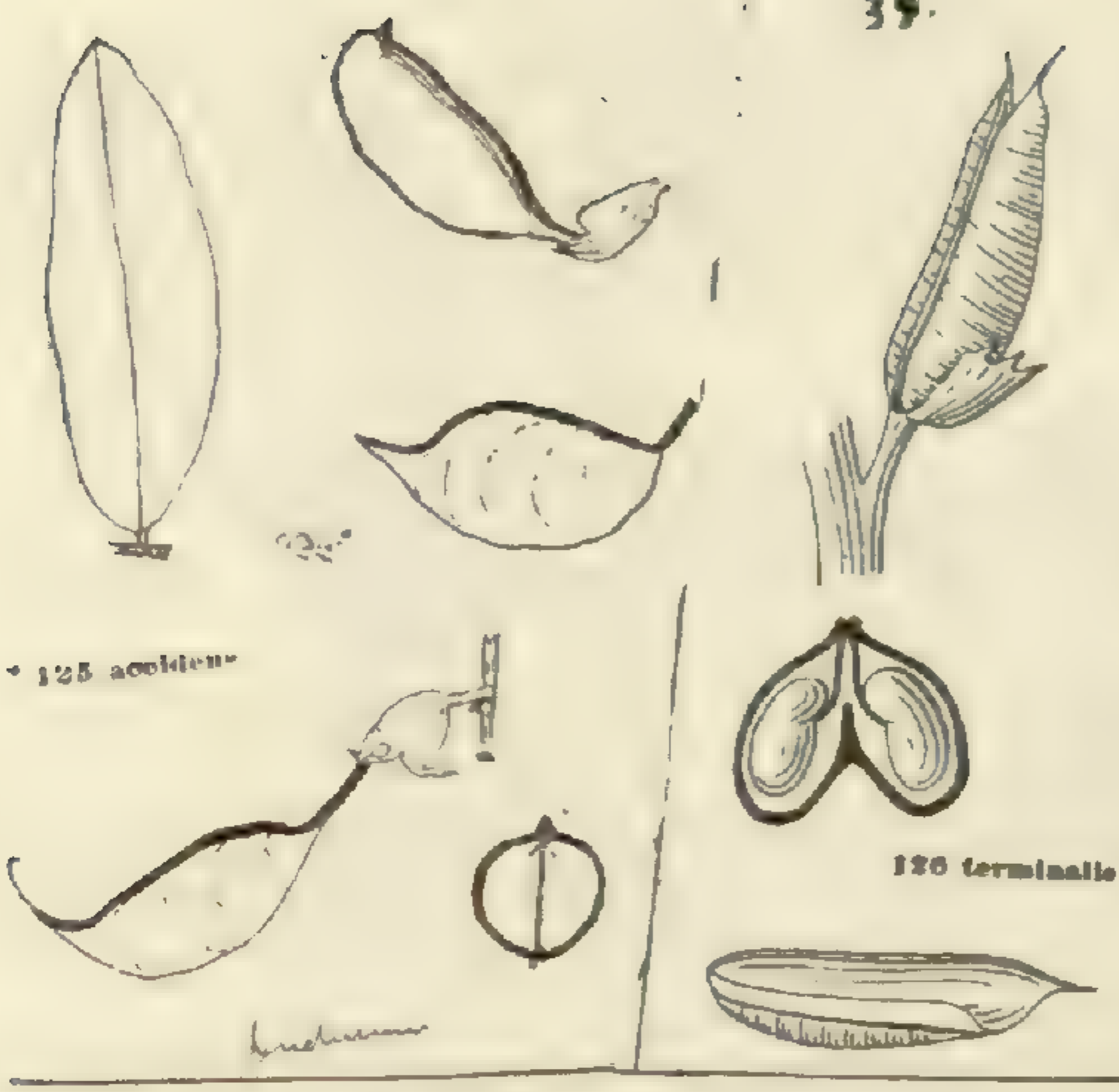


a



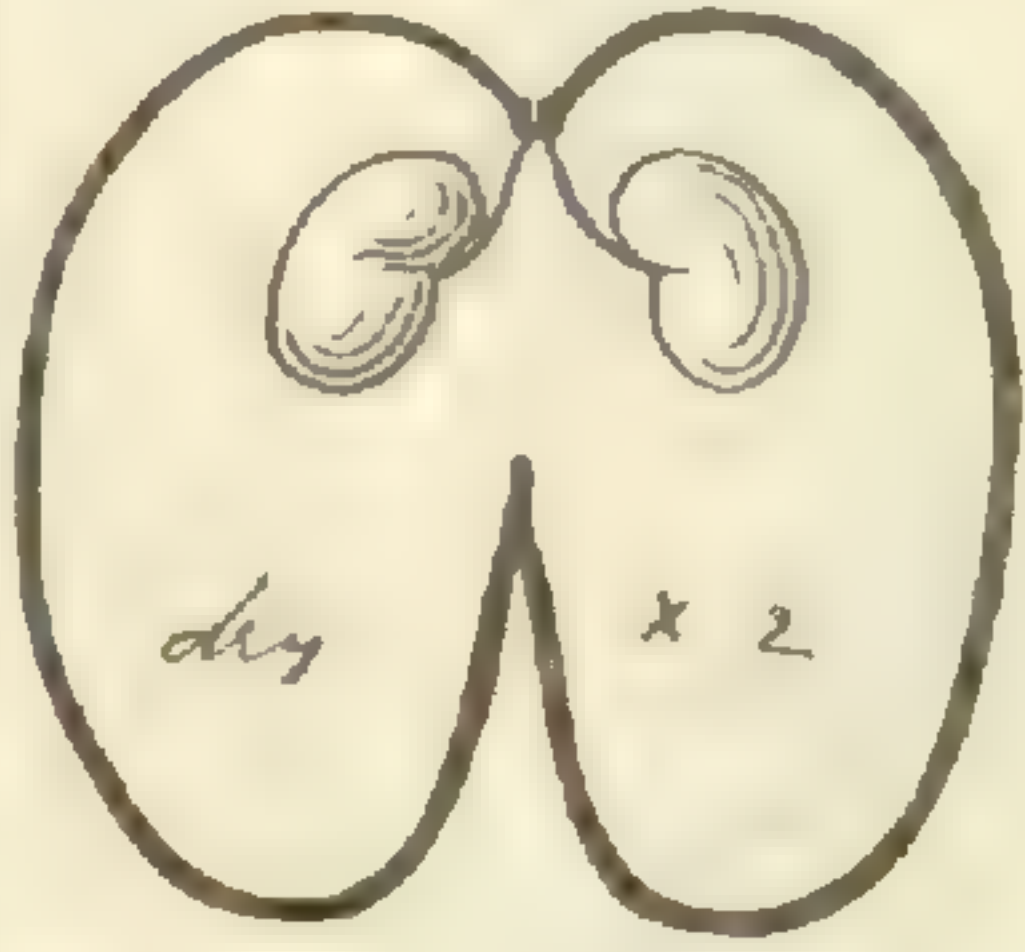
A. arrectus var.



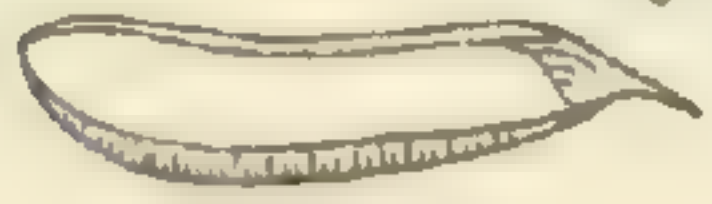




Var. Morioni



129 neglectus



dry x 2



M. ...



a b



130 nitida



nitida ...



Hydrogaster ...



dry x 2

... d

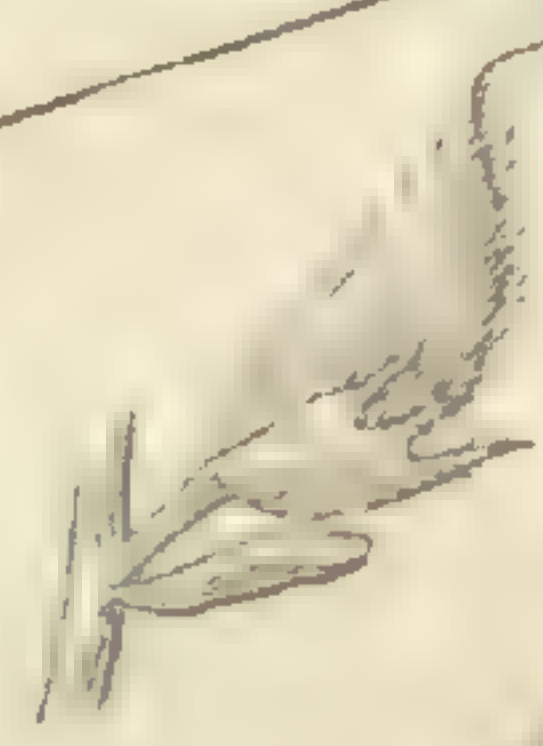


Hydrogaster ...



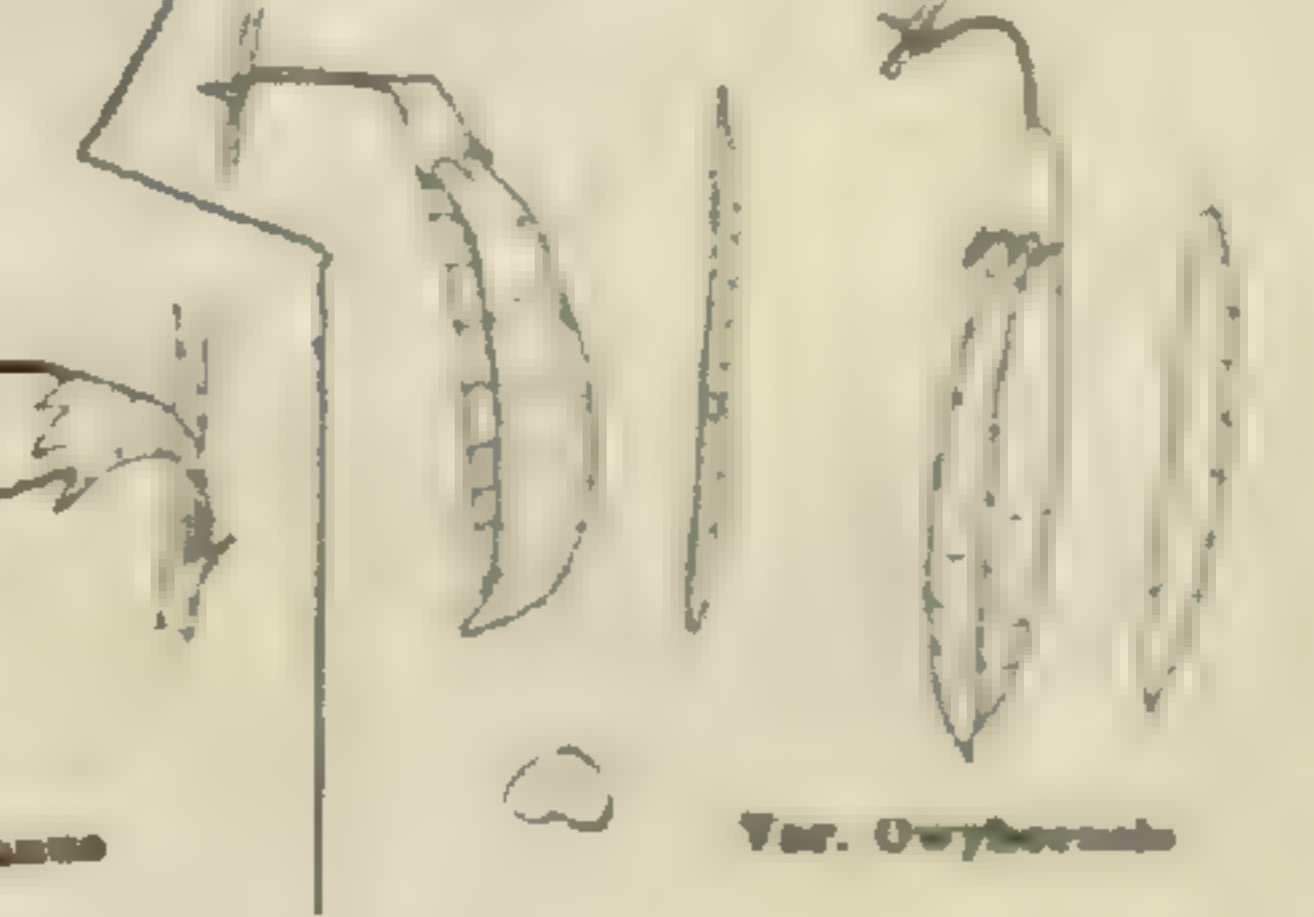
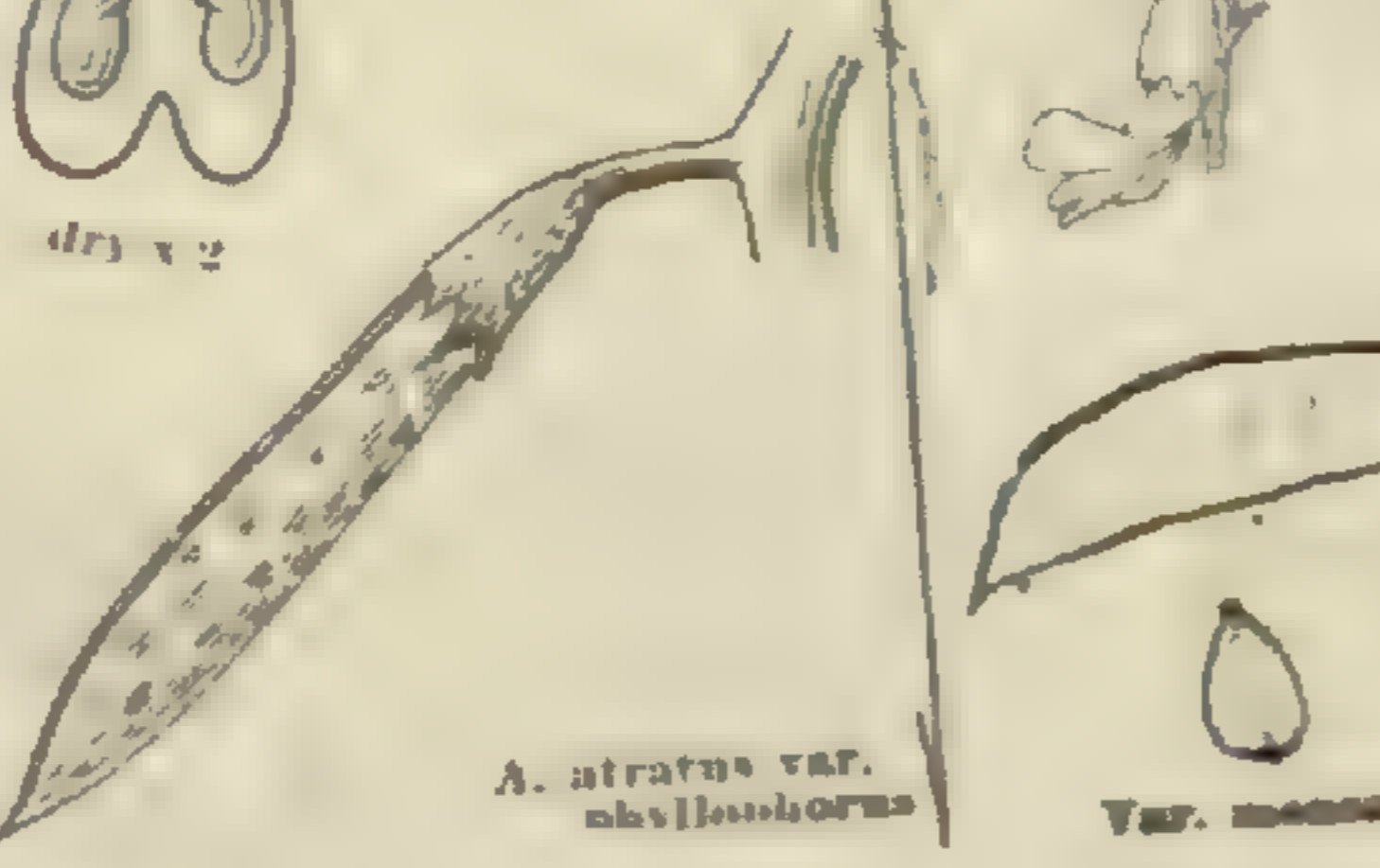
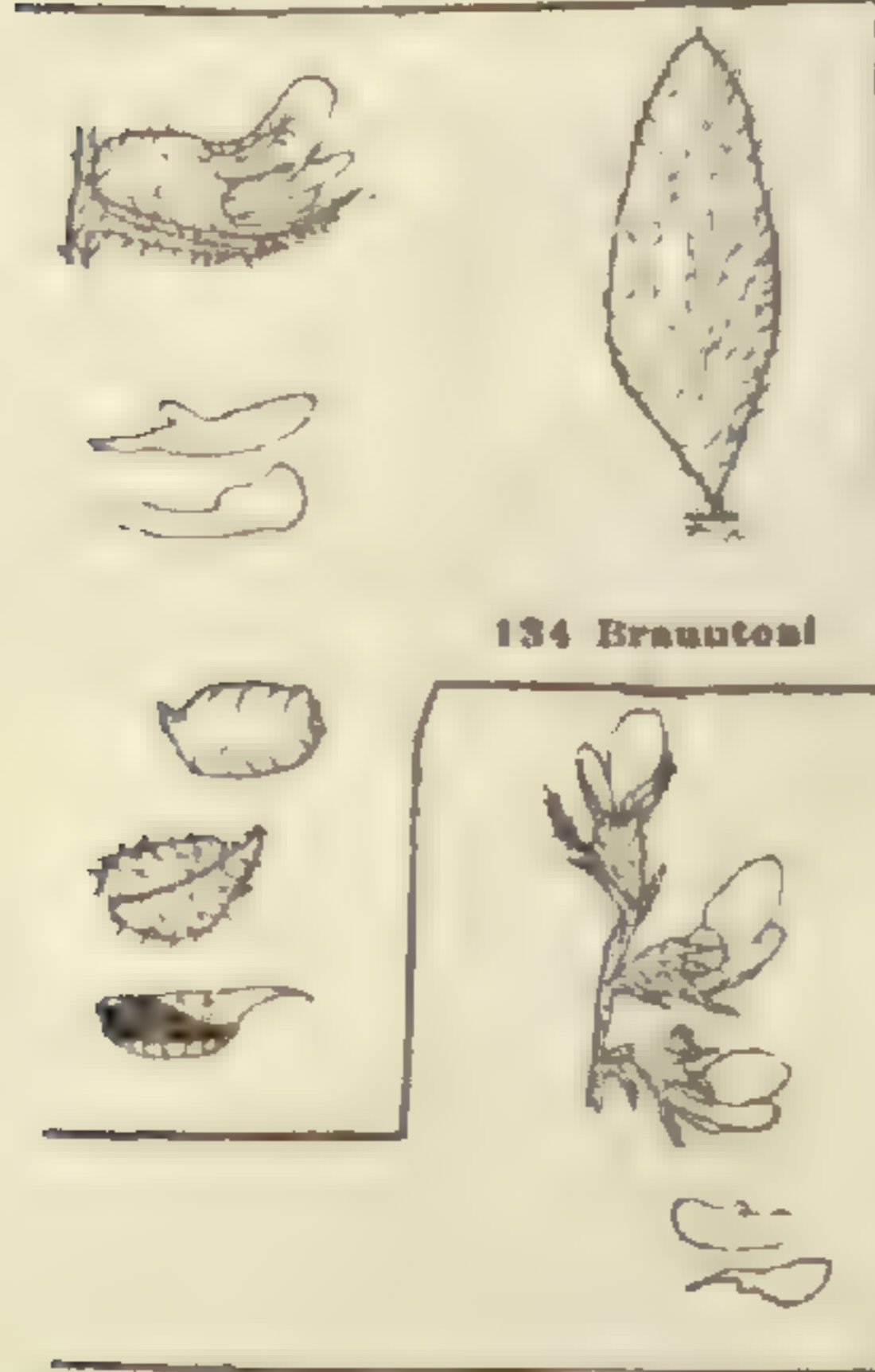
dry x 2

131 Agrestis

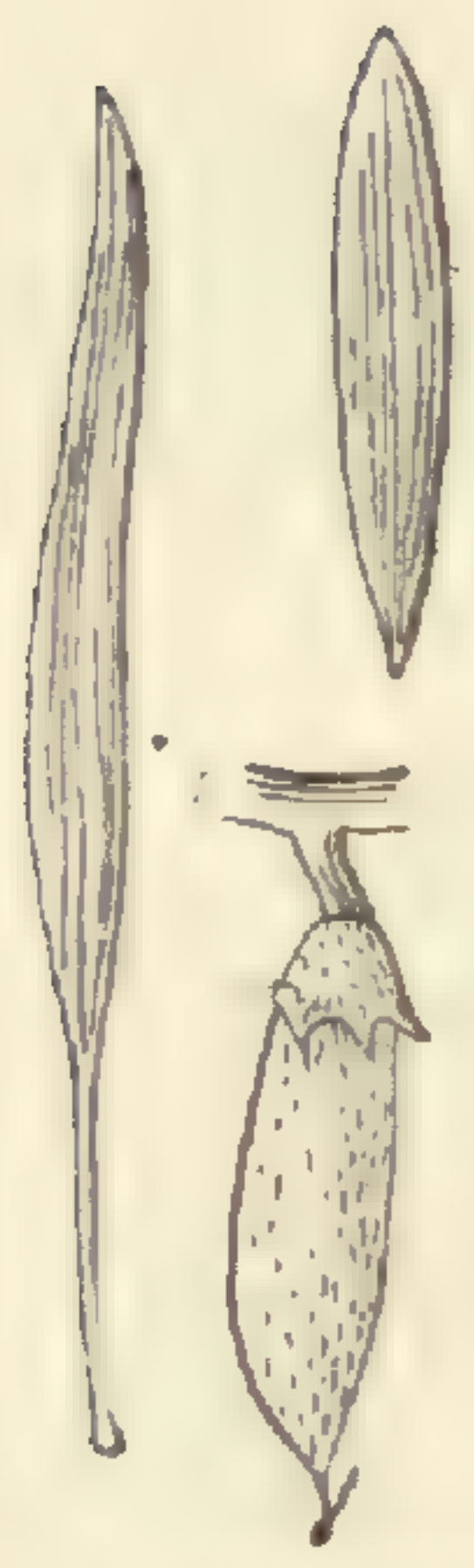


dry x 2

V. agrestis var polysperma



(42)



139 *thapensis*



140 *Panamintensis*



141 *recurva*



143 *strataensis*



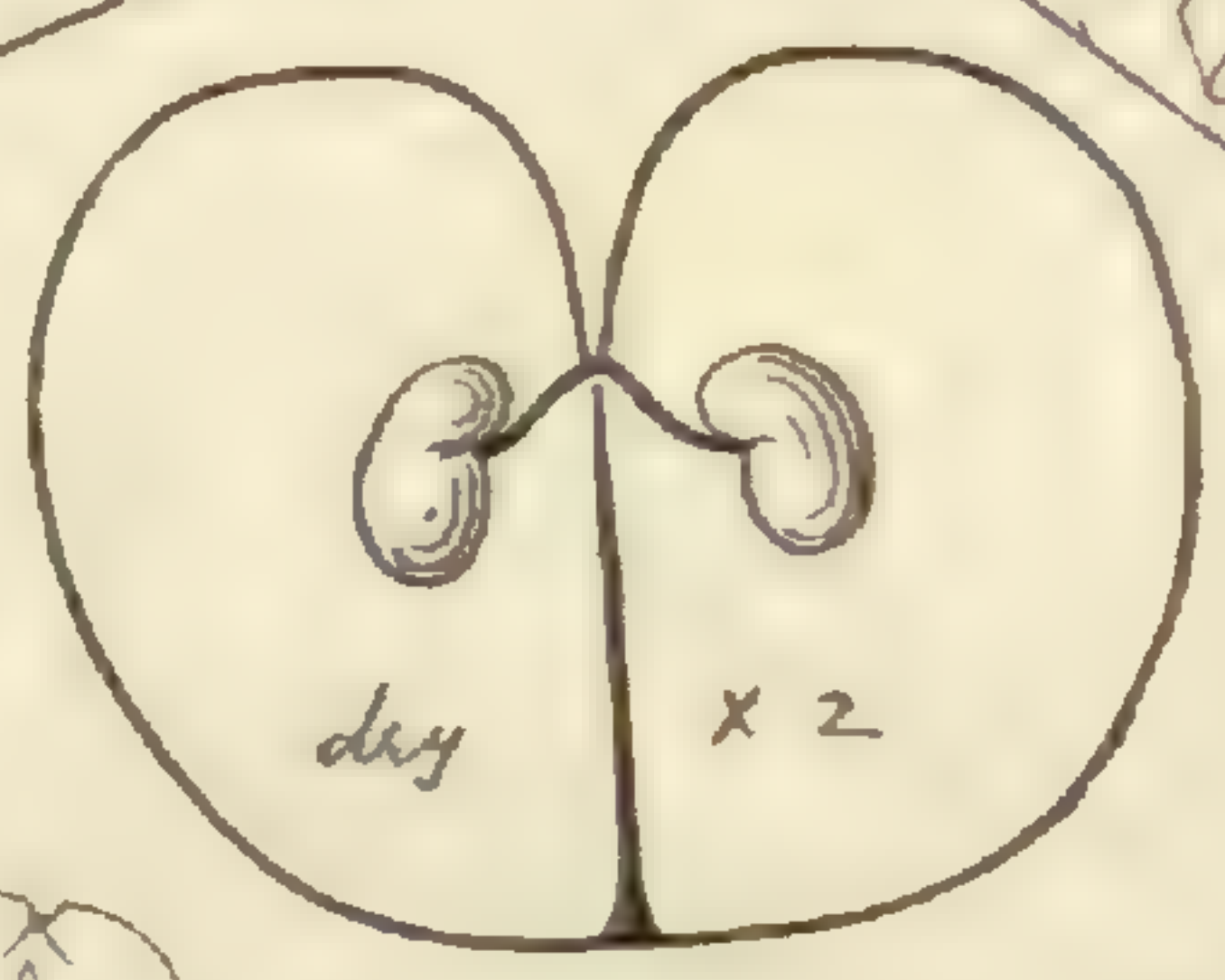
143 *strigulosus*



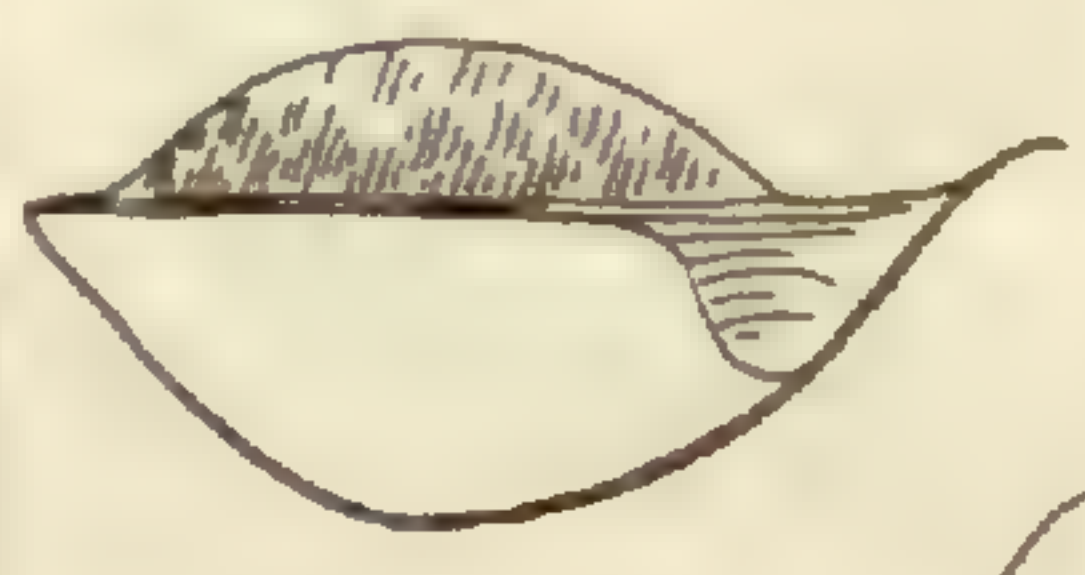
Var. *gracilis*



Var. *providentensis*



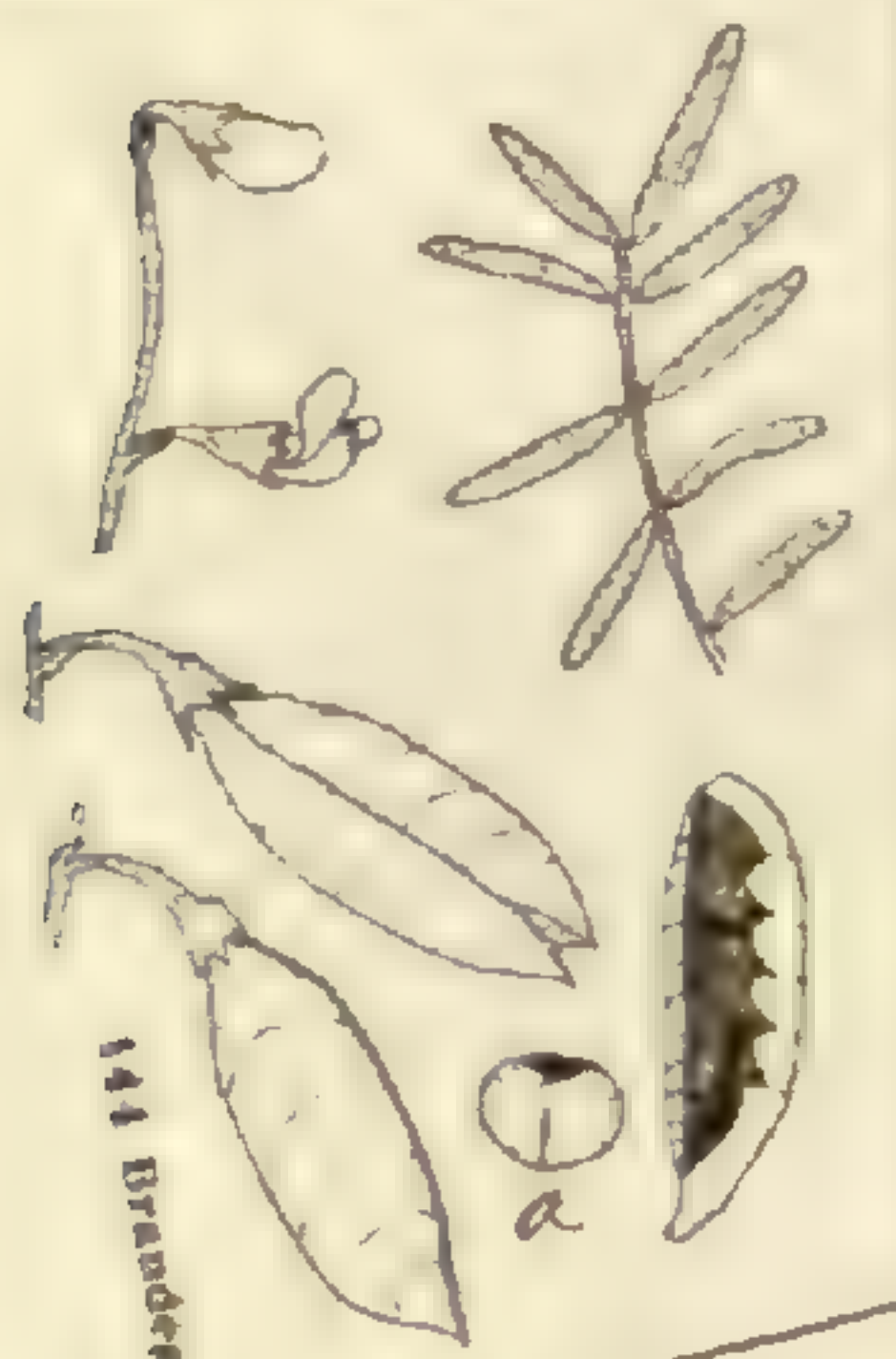
dry x 2



145 *platytrapa*



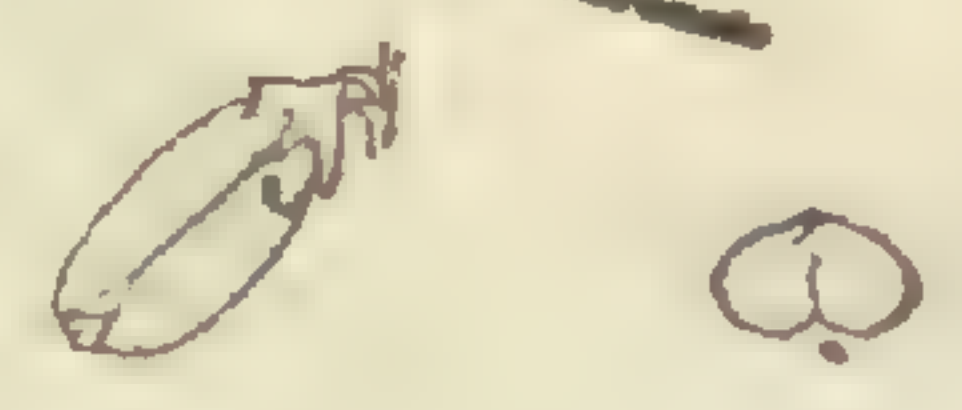
a



144 *Brandegei*

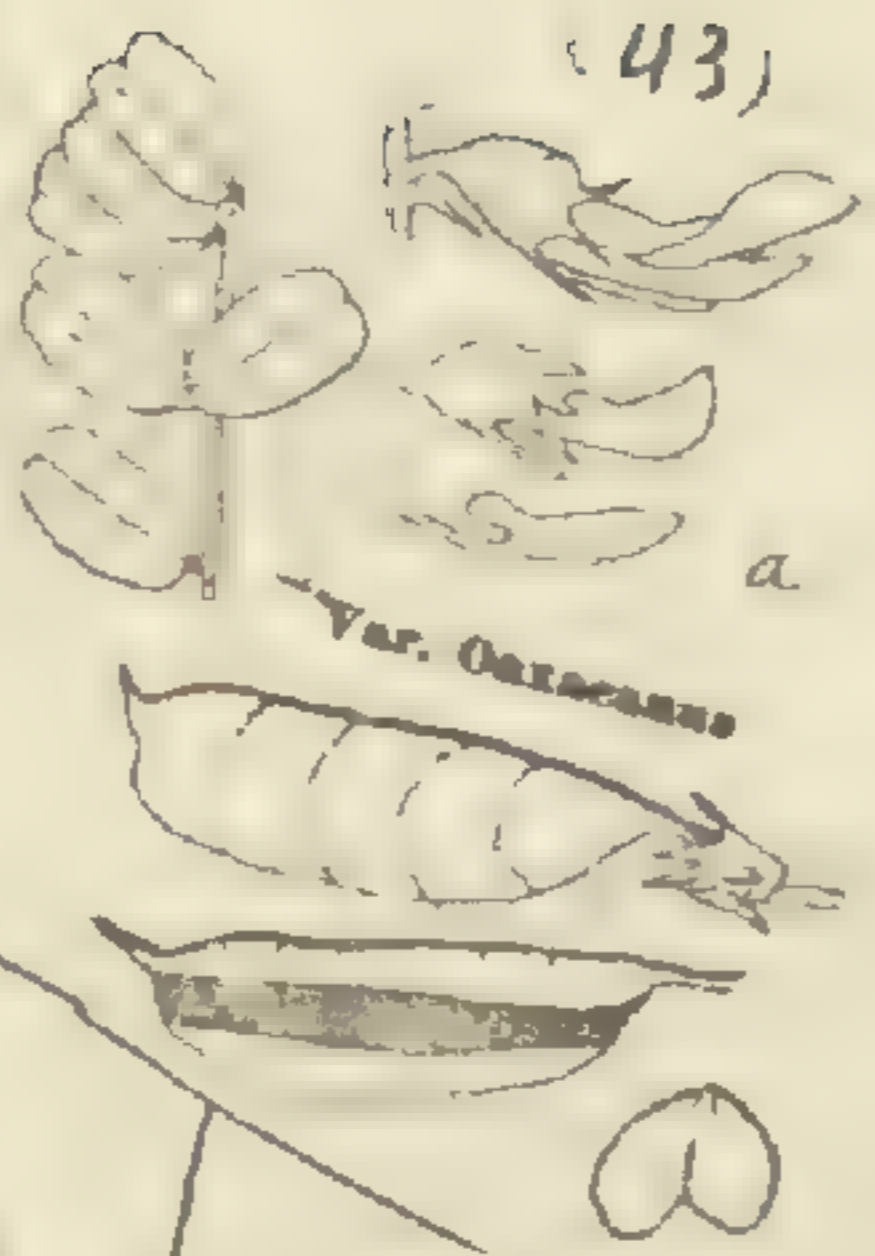


146 *Cabrerae*

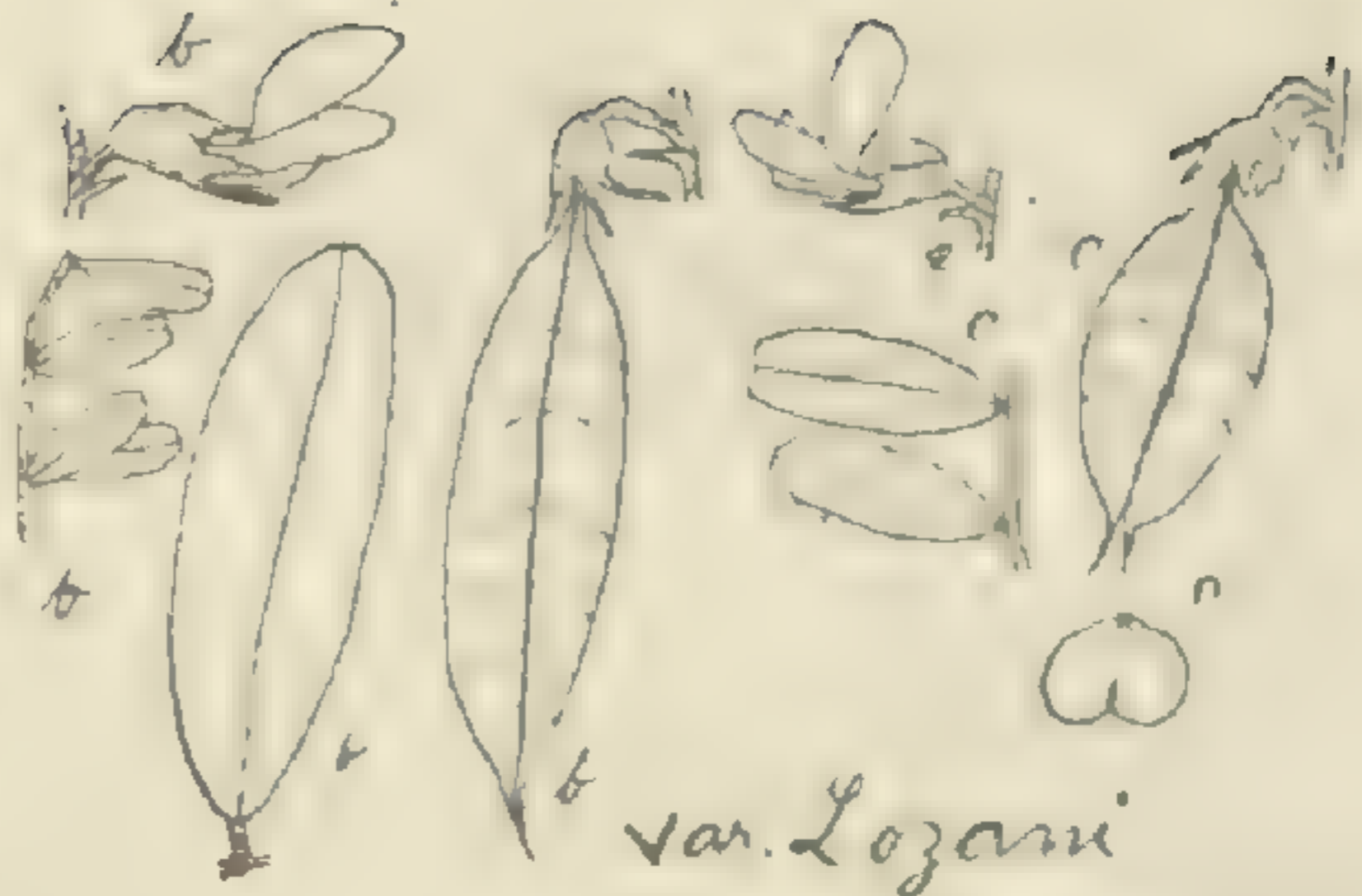




147 Guatemalaensis



Var. Oaxacensis



Var. Lozani



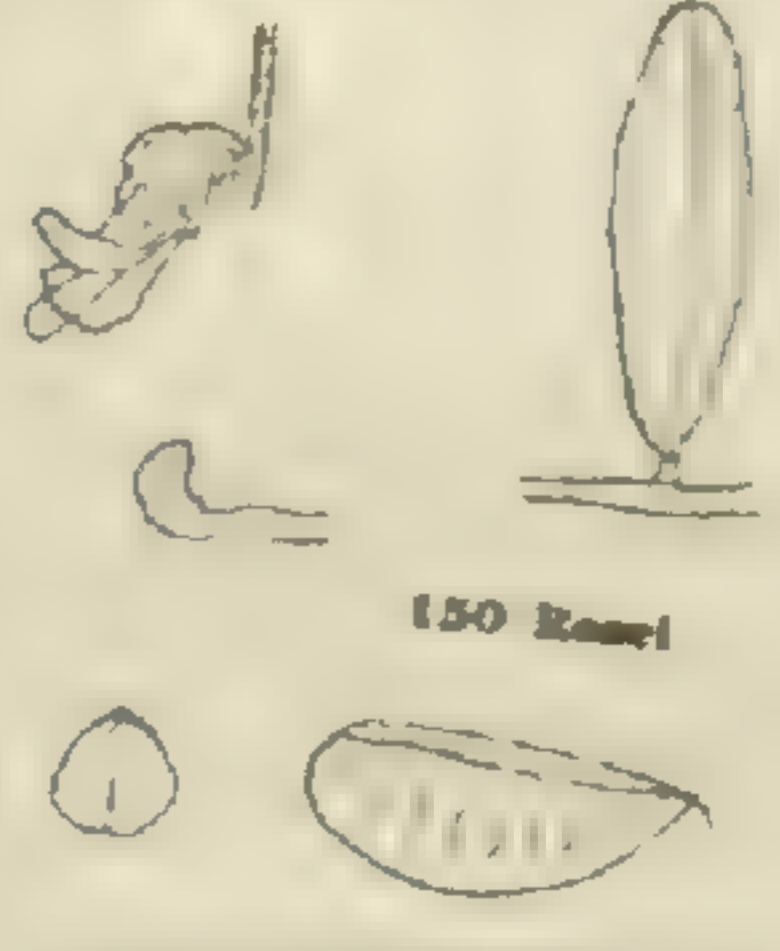
bidentatus



148 Painteri



149 Telucanus



150 Kawi



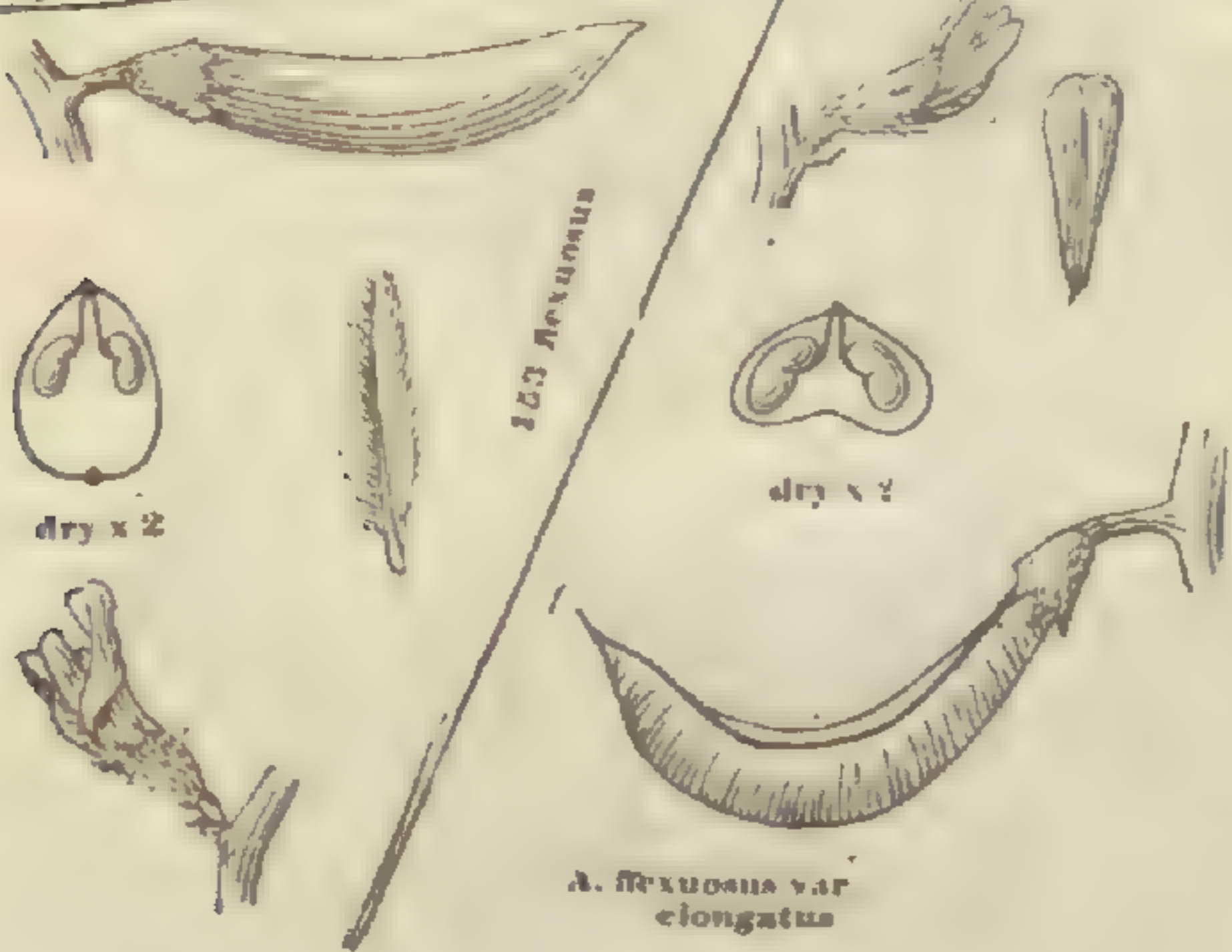
151 roplasi



152 parviflora



Var. microlobus



A. flexuosus var. elongatus



154 Diehlii



155 gracilentus



Var. Hallii



Var. Greenii



150 Romanianus



Var. filix



Var. sturtii



158 pleuralis



157 Astorianus



diag x 2

100 Sibiricus



161 Webberii



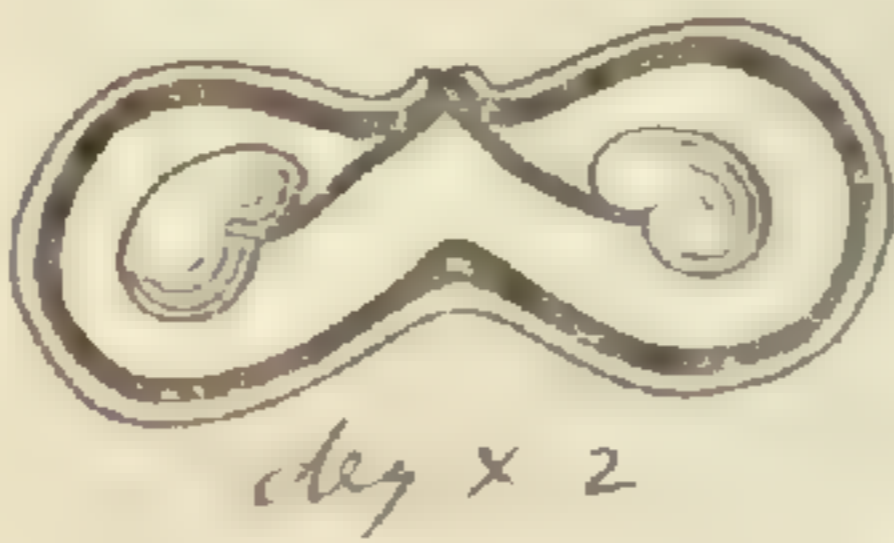
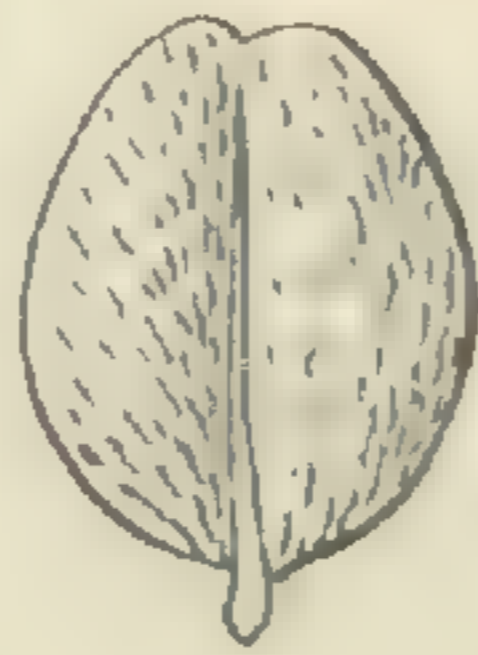
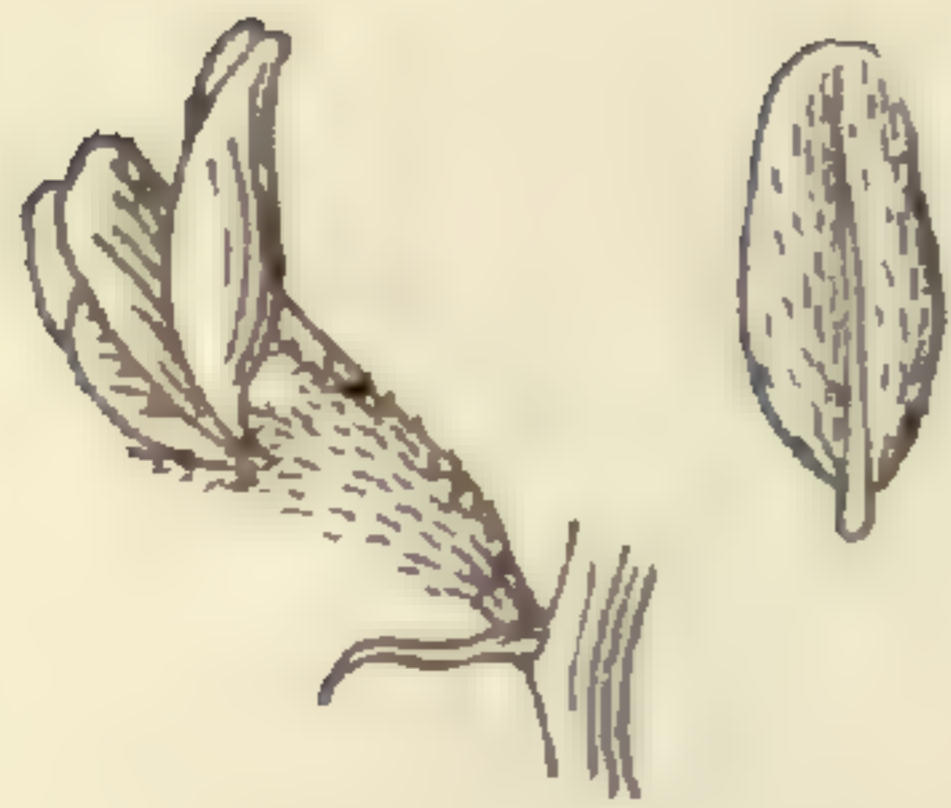
diag x 2



Var. carlarus



diag x 2



103 fedanthus

104 desertus



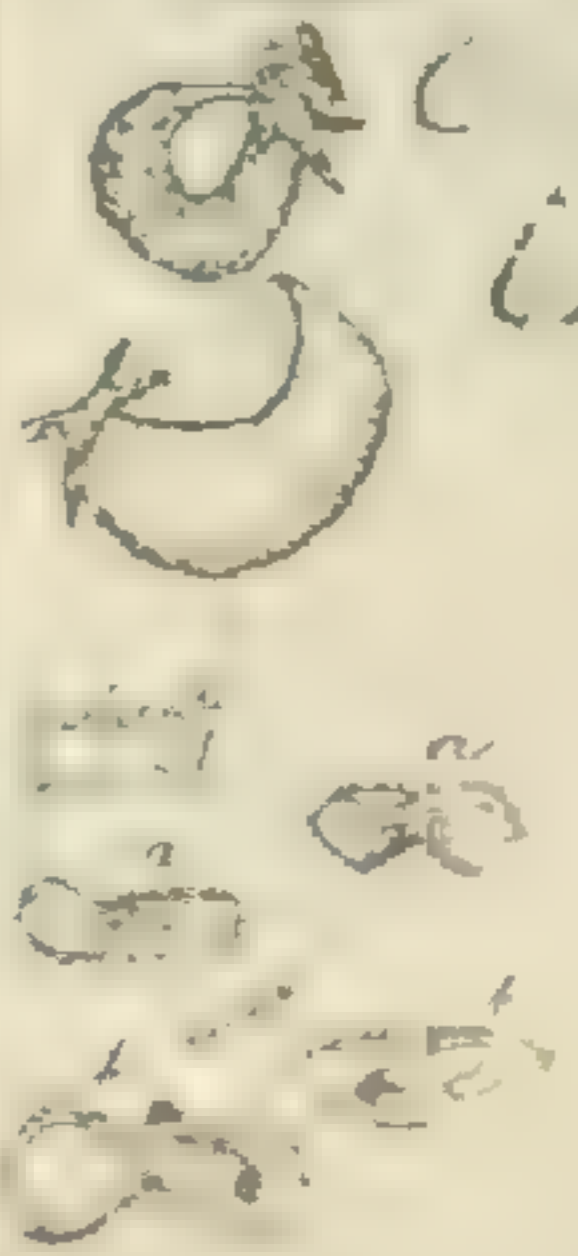
Var. petrophilus



106 hortianus



stipularis





dry 2

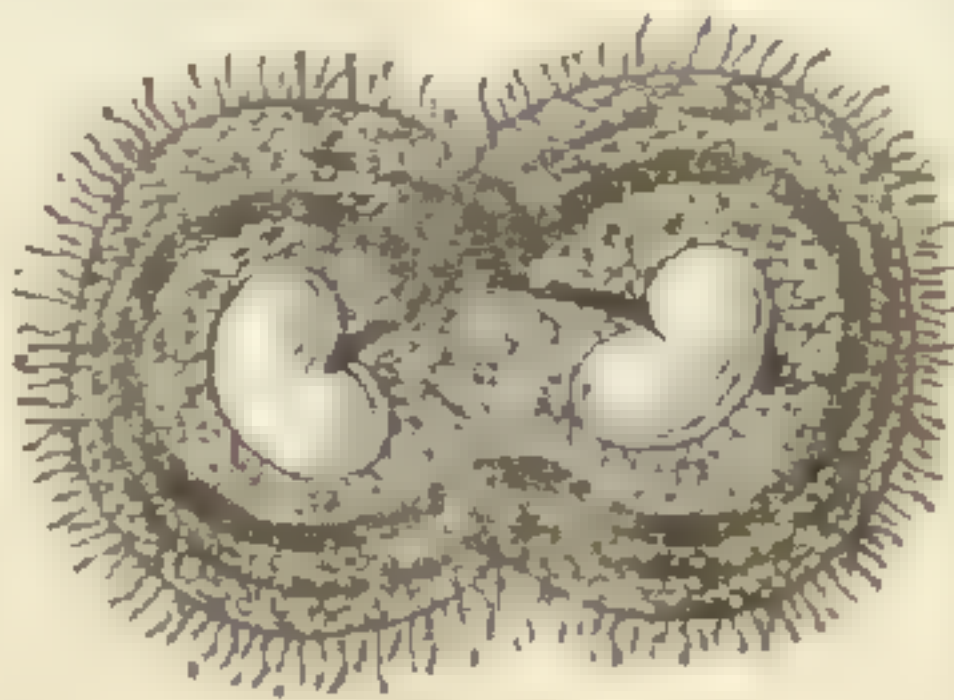


dry x 2

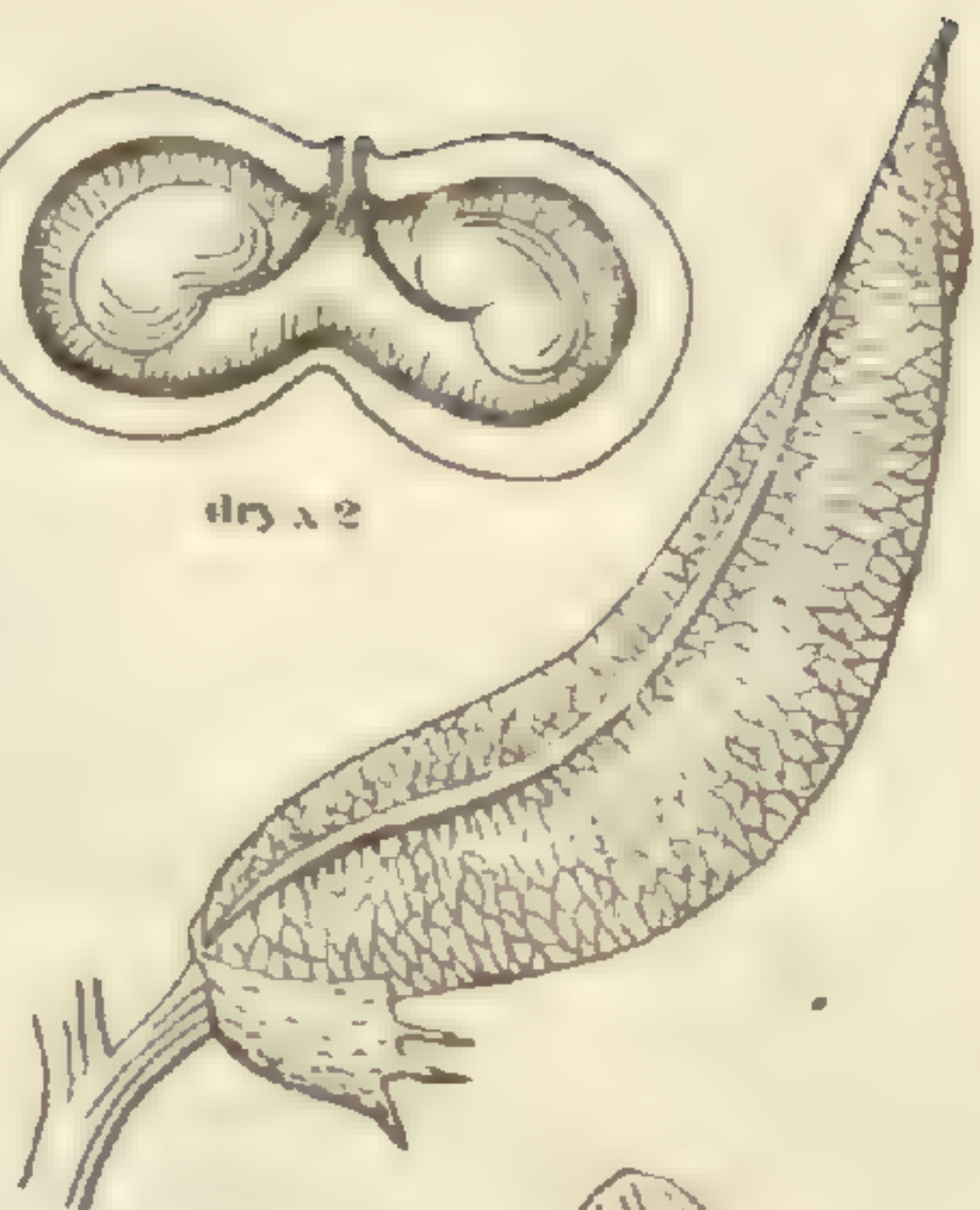
Shortianus



a



fresh x 2



dry x 2

A. Shortianus var. cyanus



dry x 2

A. argophyllus



A. argophyllus



dry x 2

Var. onicensis



dry x 2



a



a

arg. unicolor



a



a

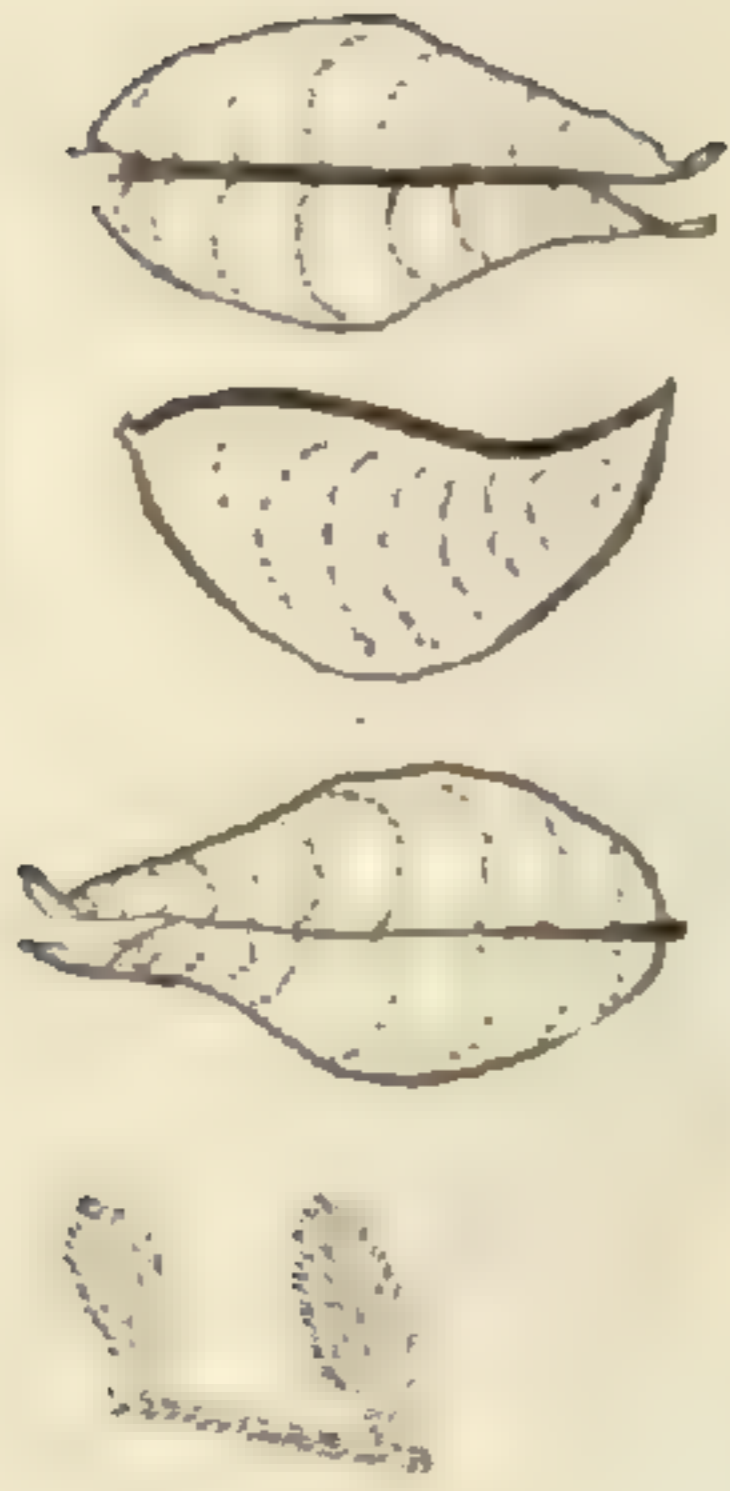


dry x 2



A. argophyllus x Utabensis

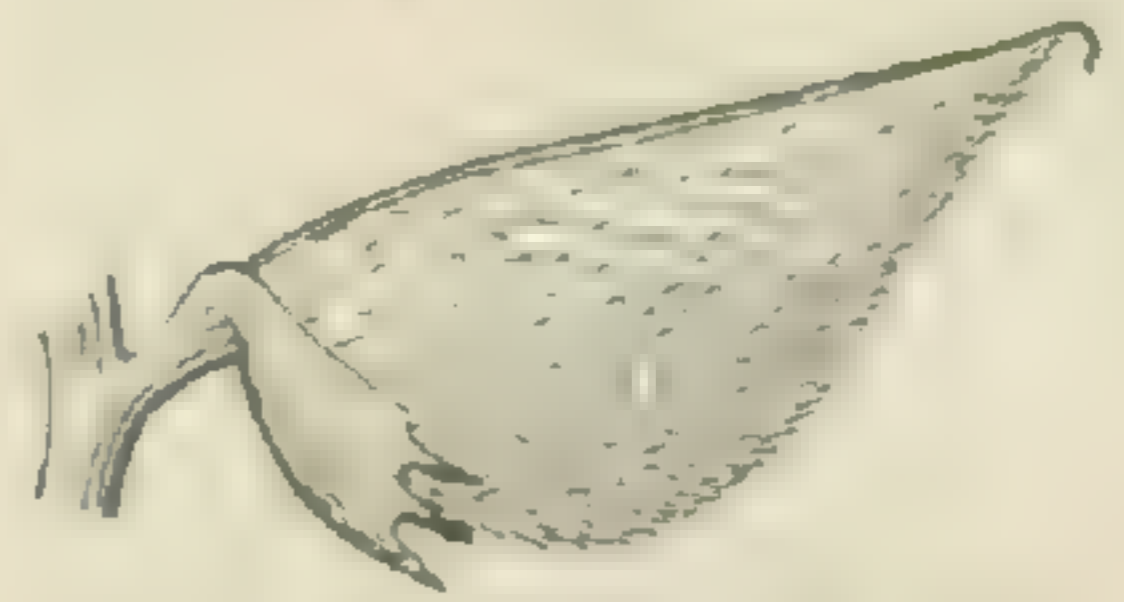
Var. Meritini



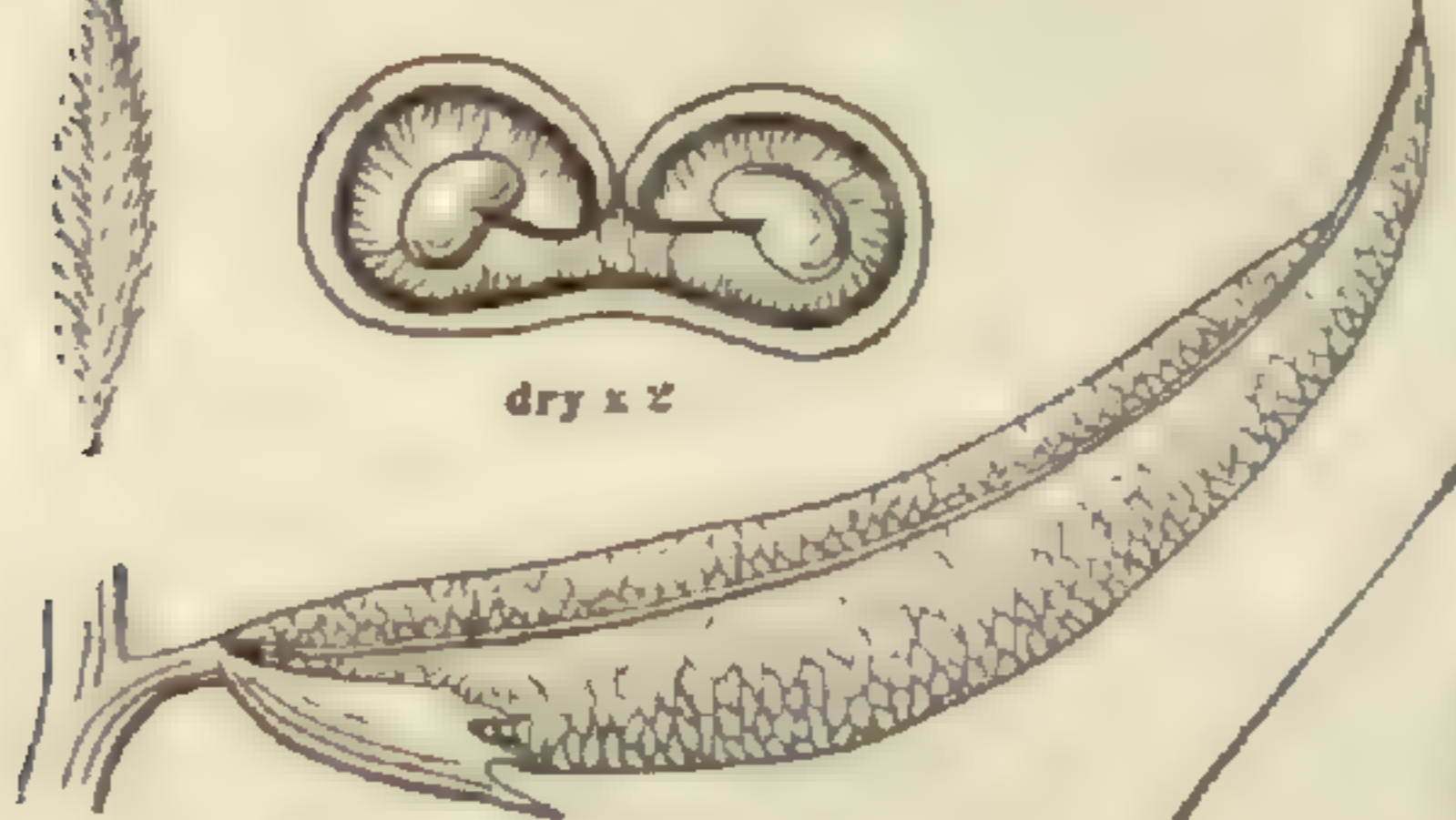
147?



Var. pephragmenus



dry x 2



Var. Pangulocensis



dry x 2

A. argophytus var. castanea-formis



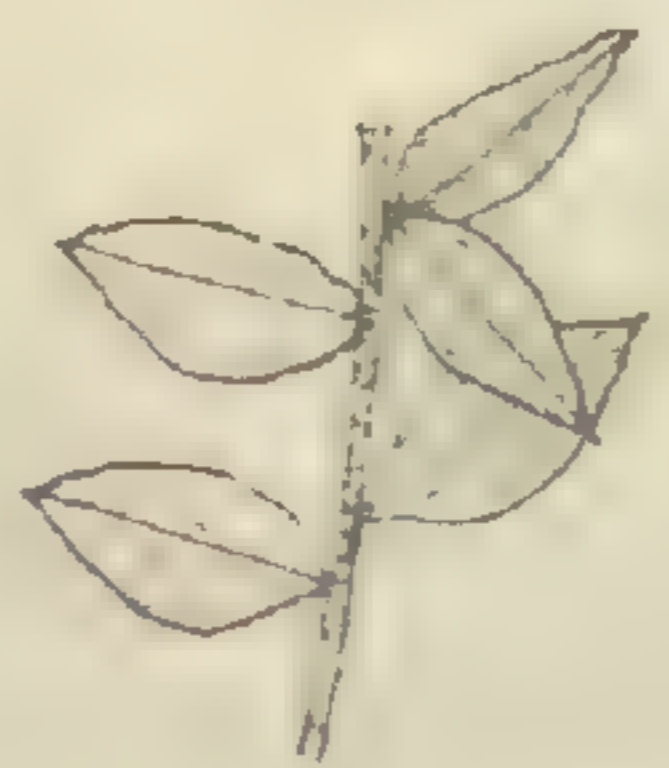
dry x 2



argophytus Linnaeus x Purshii



158 Zizania

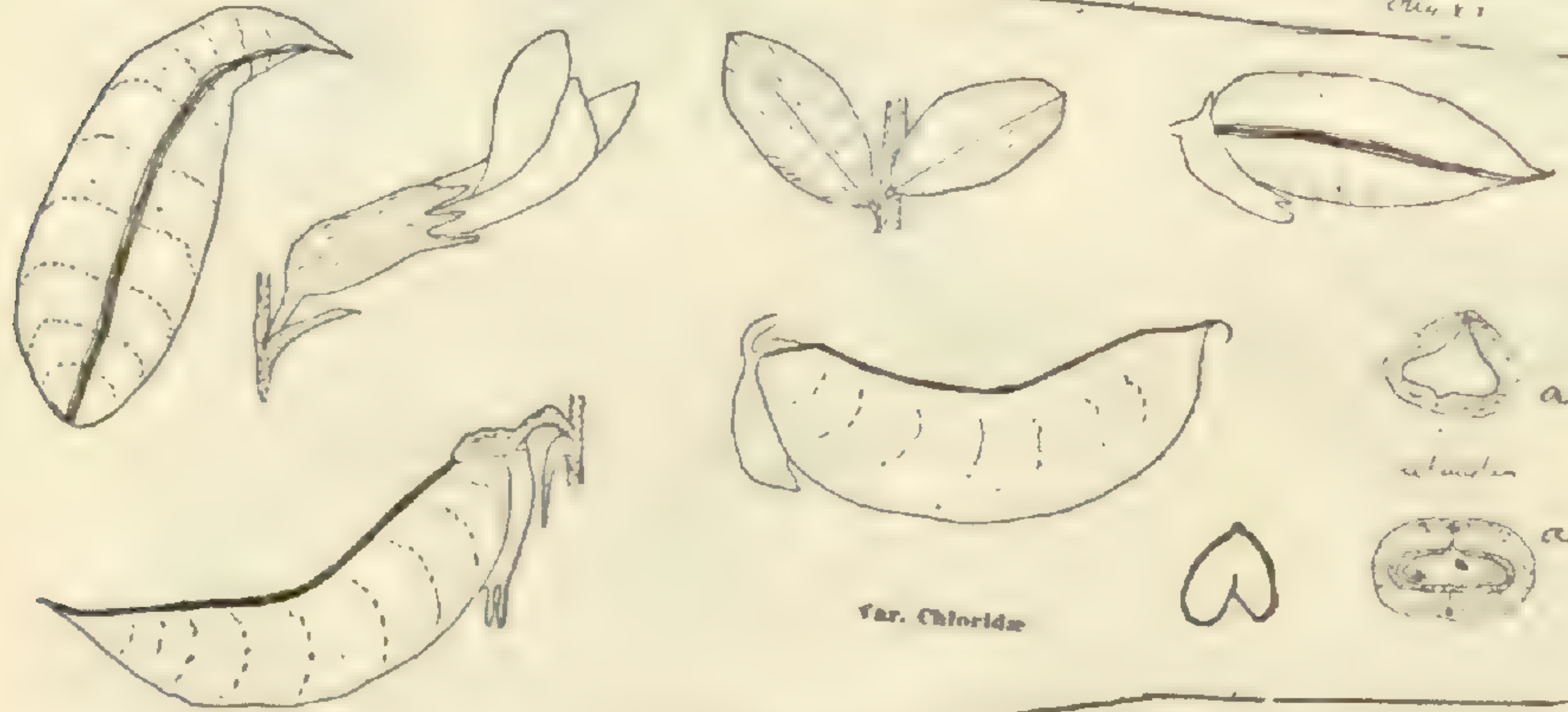




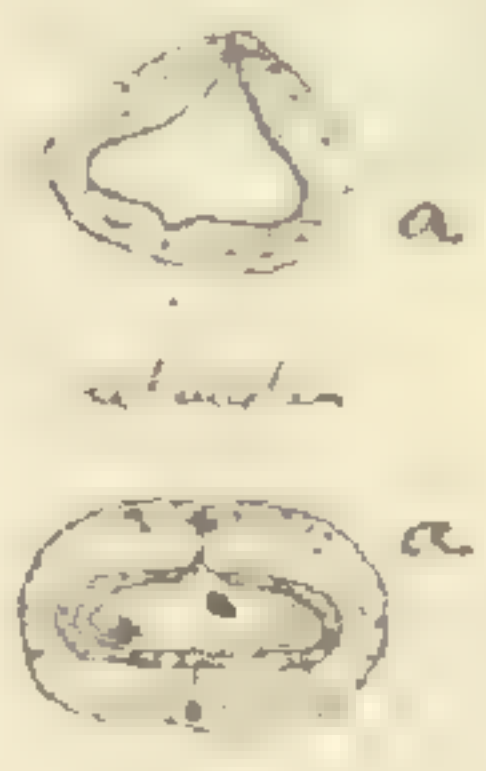
169 remoulens



diag. x 1



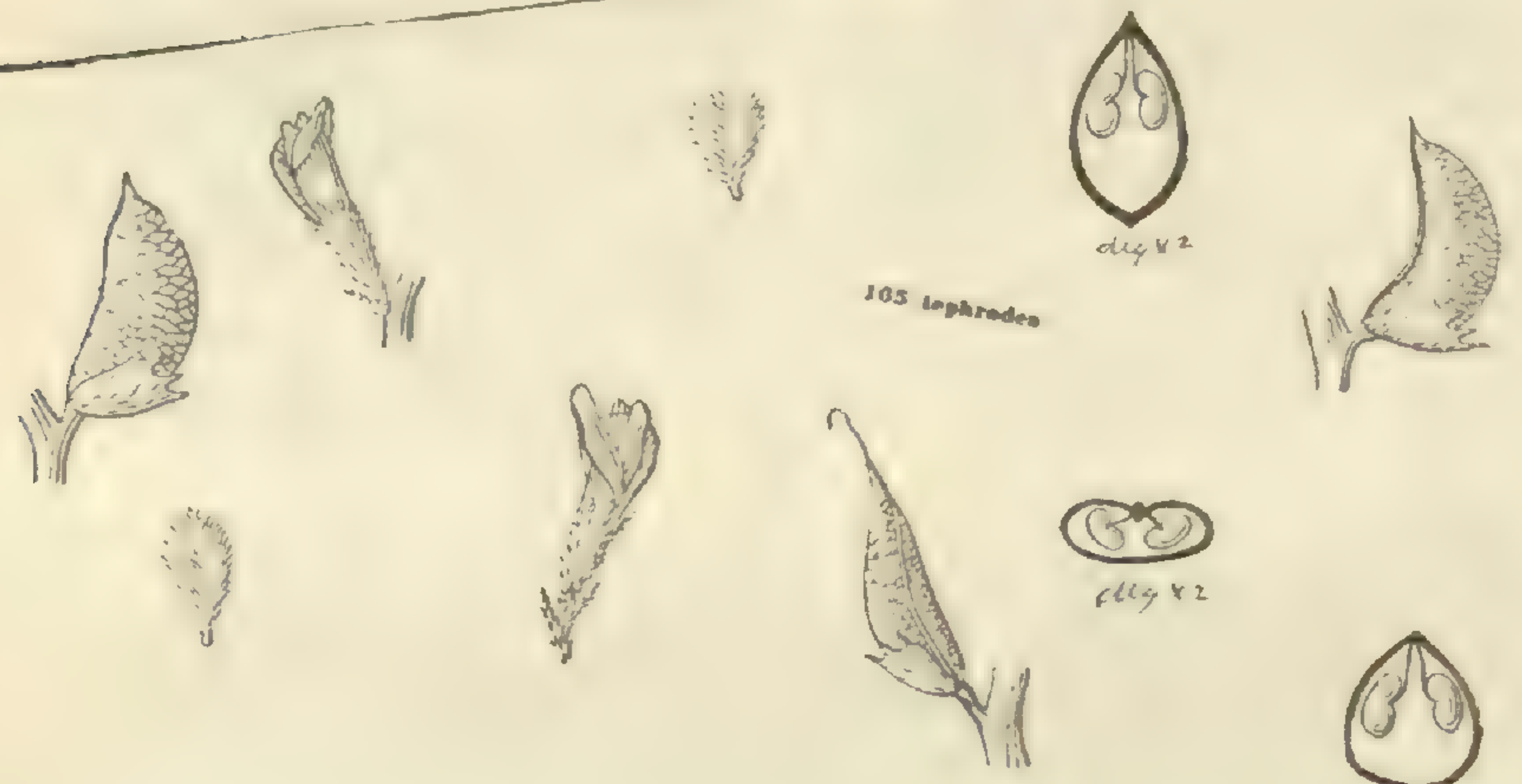
var. Chloride



a

retrofracta

a



165 lephrodes



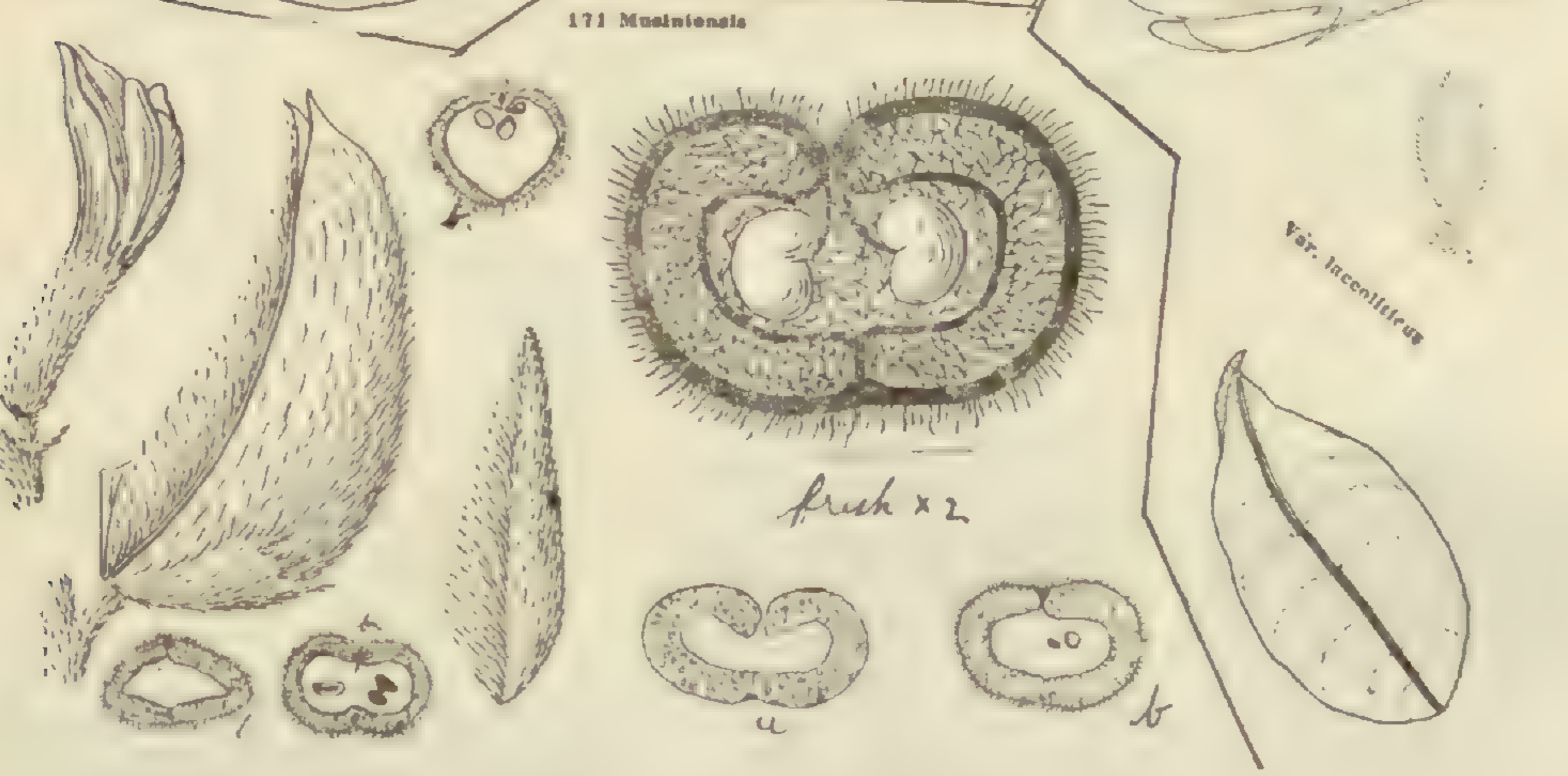
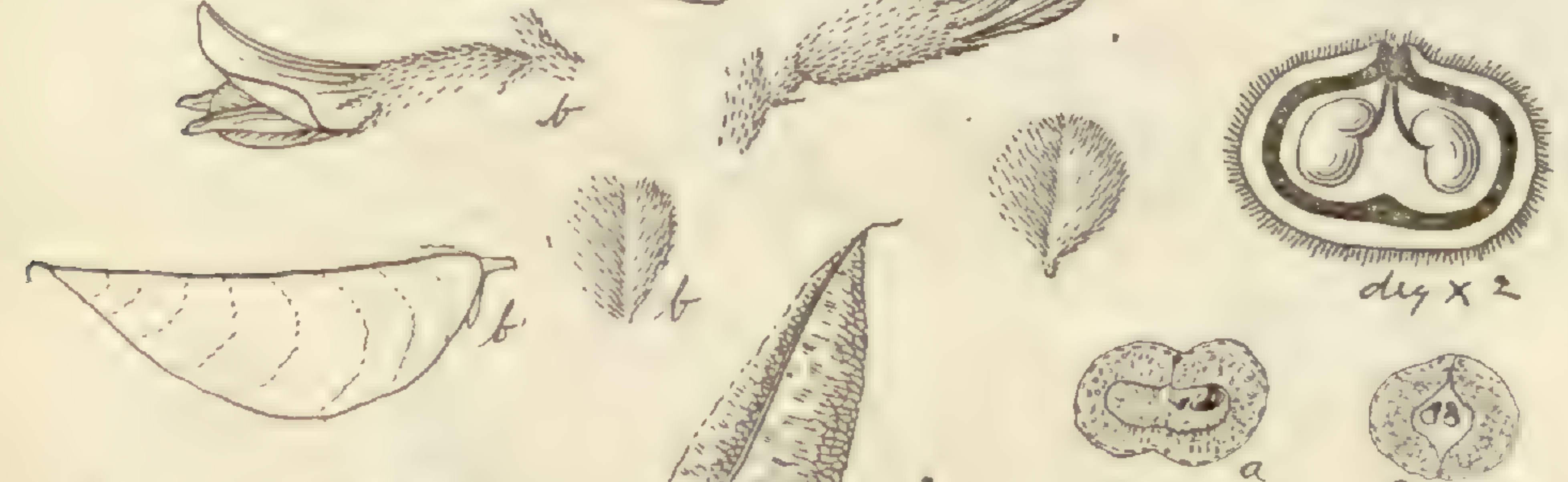
diag. x 2



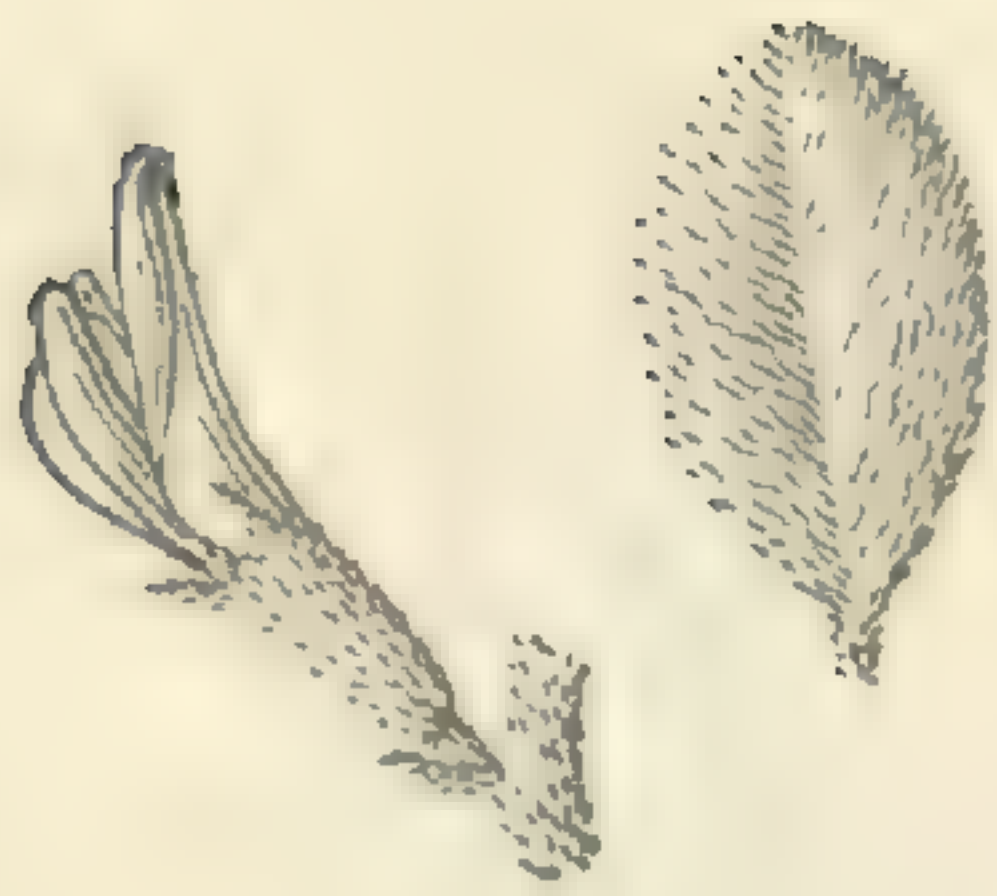
diag. x 2



diag. x 2

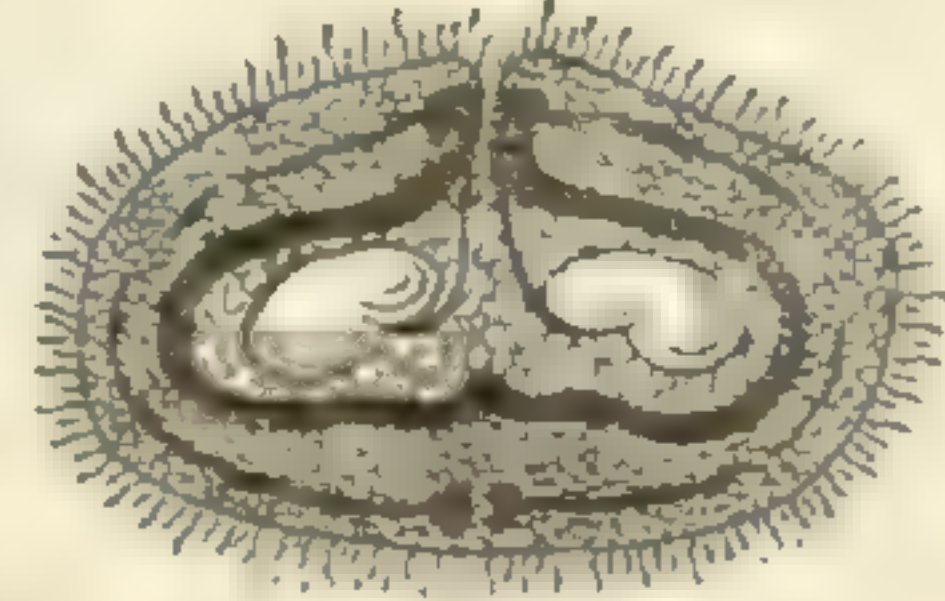


Var. *laeviflorus*



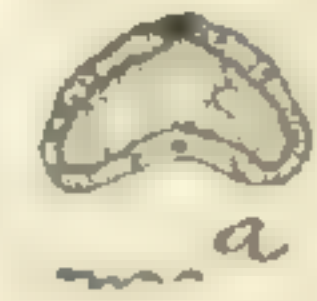
fresh x 2

172 symbolde



fresh x 2

173 Missouriensis



Var. cuspidocarpus

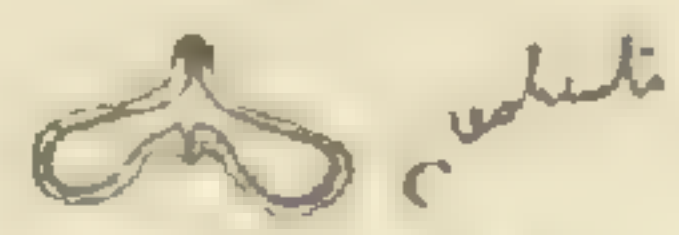


fresh x 2



small leaf

volenti of ante



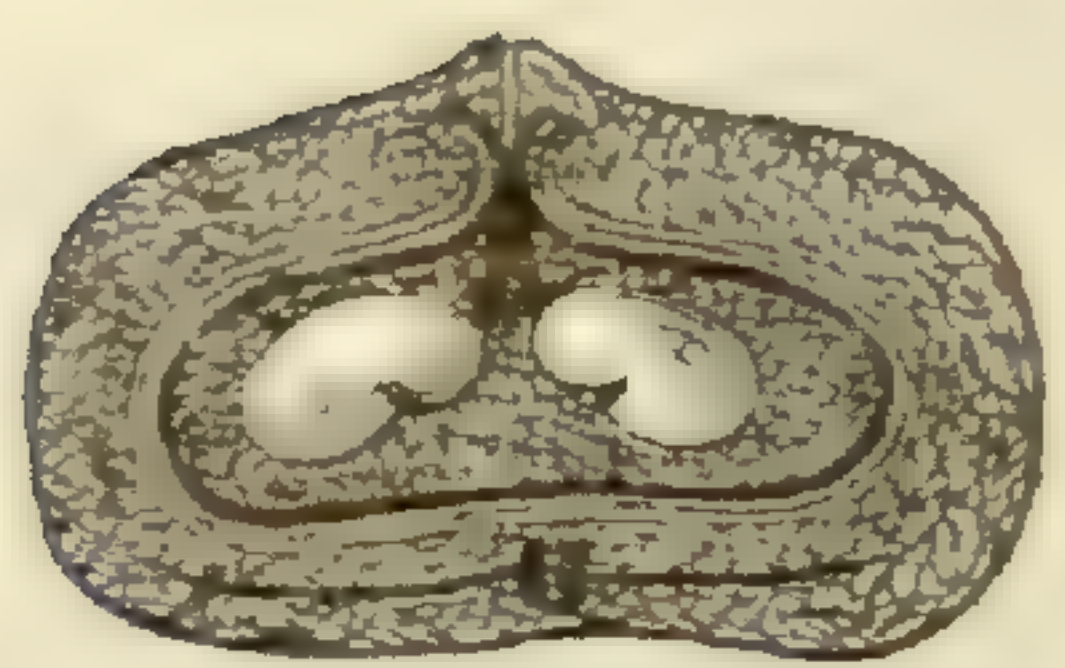
volenti



volenti

174 amphioxys

1/2 red flower



fresh x 2



dry x 2

577



dry x 2



dry x 2

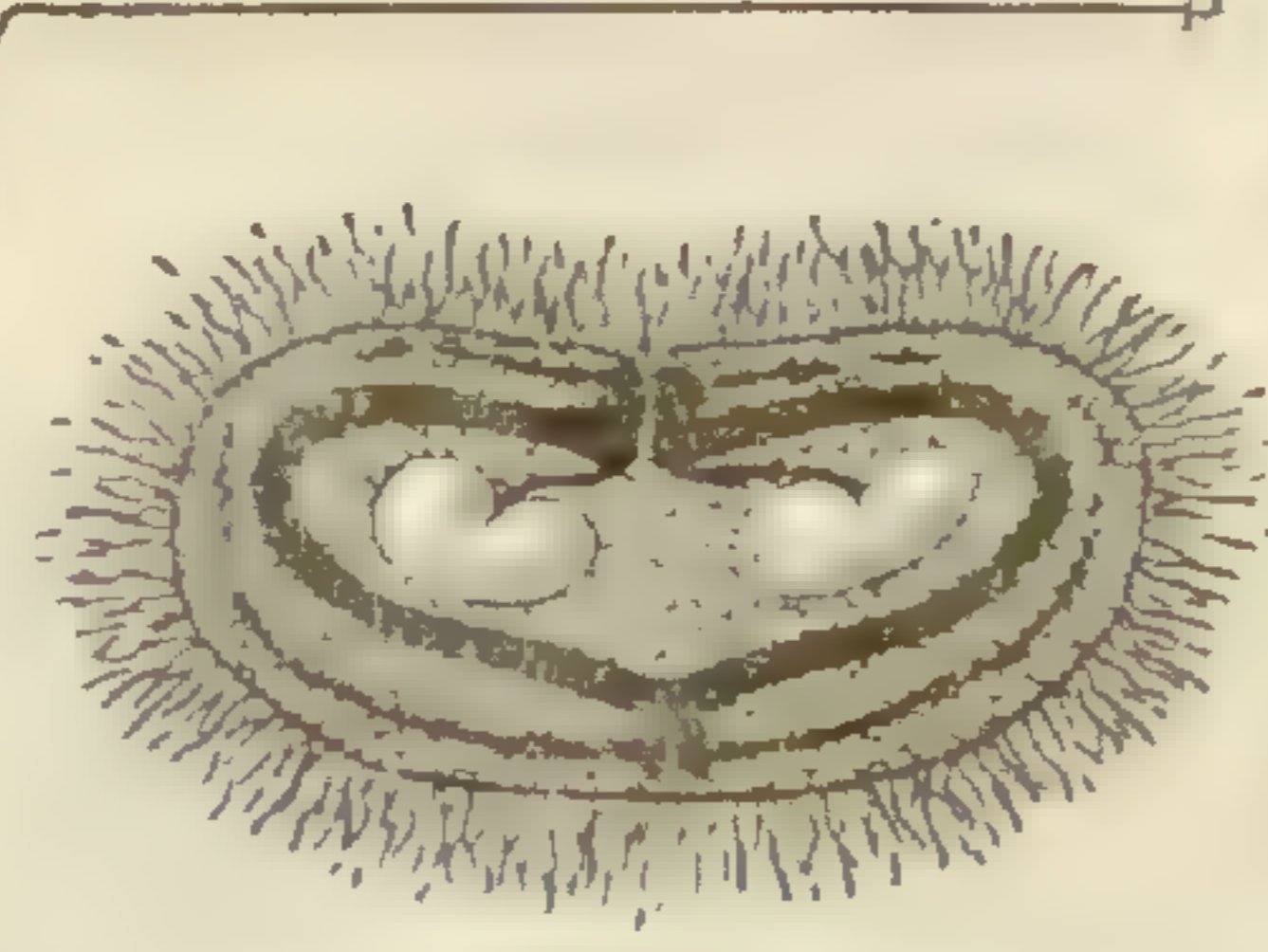
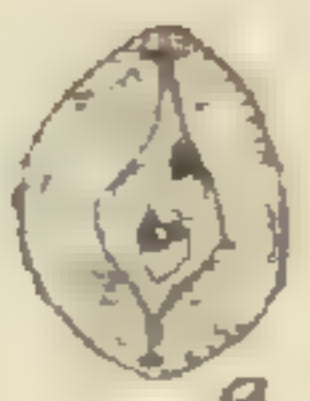
174 amphioxys



dry x 2



Var. cymbellus



fresh x 2



Var. vesperiano



b

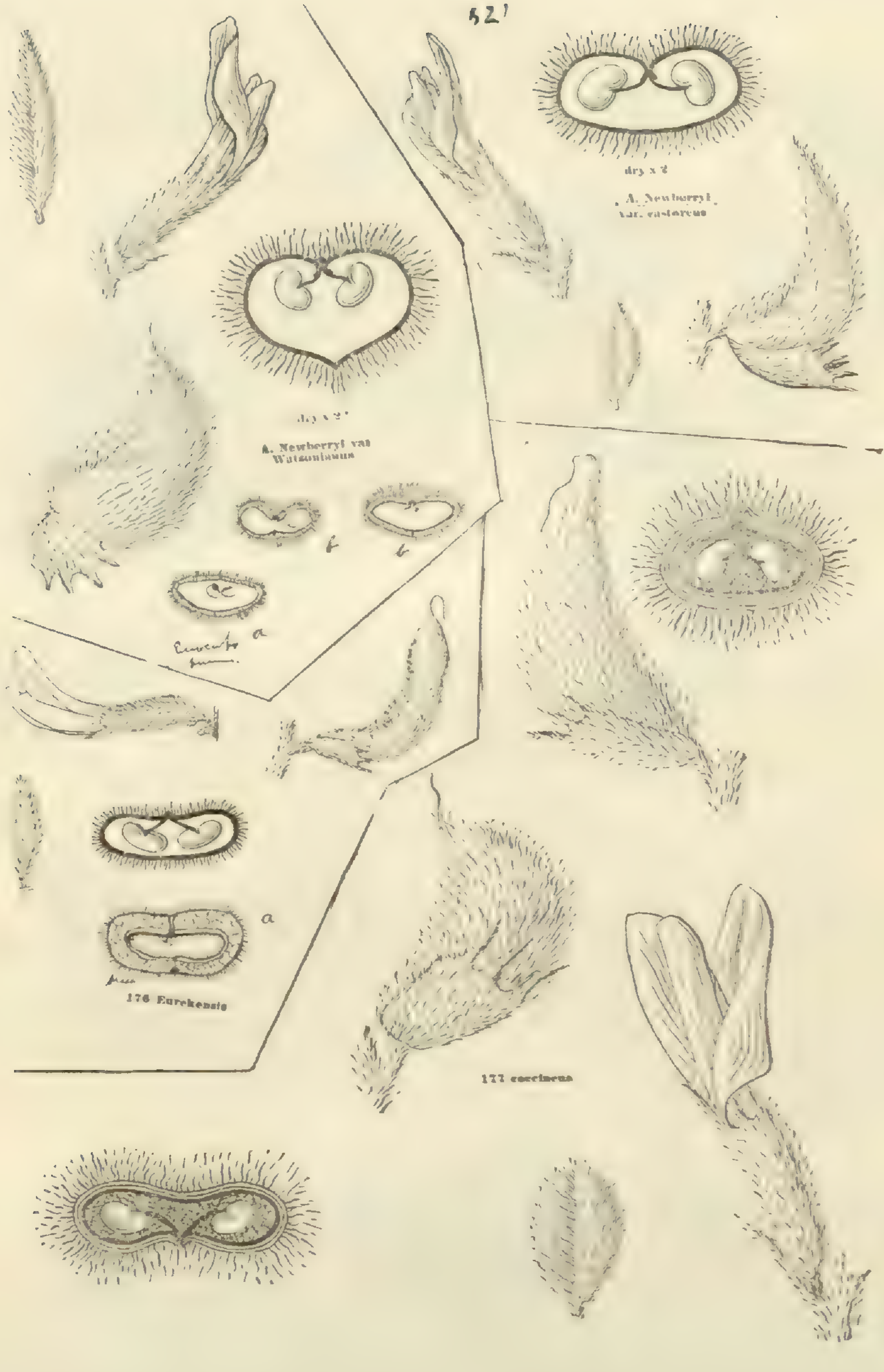
175 Newberryi



dry
gr



175 Newberryi



dry x 2

A. Newberryi
var. castoreus

dry x 2

A. Newberryi var
Watsonianus

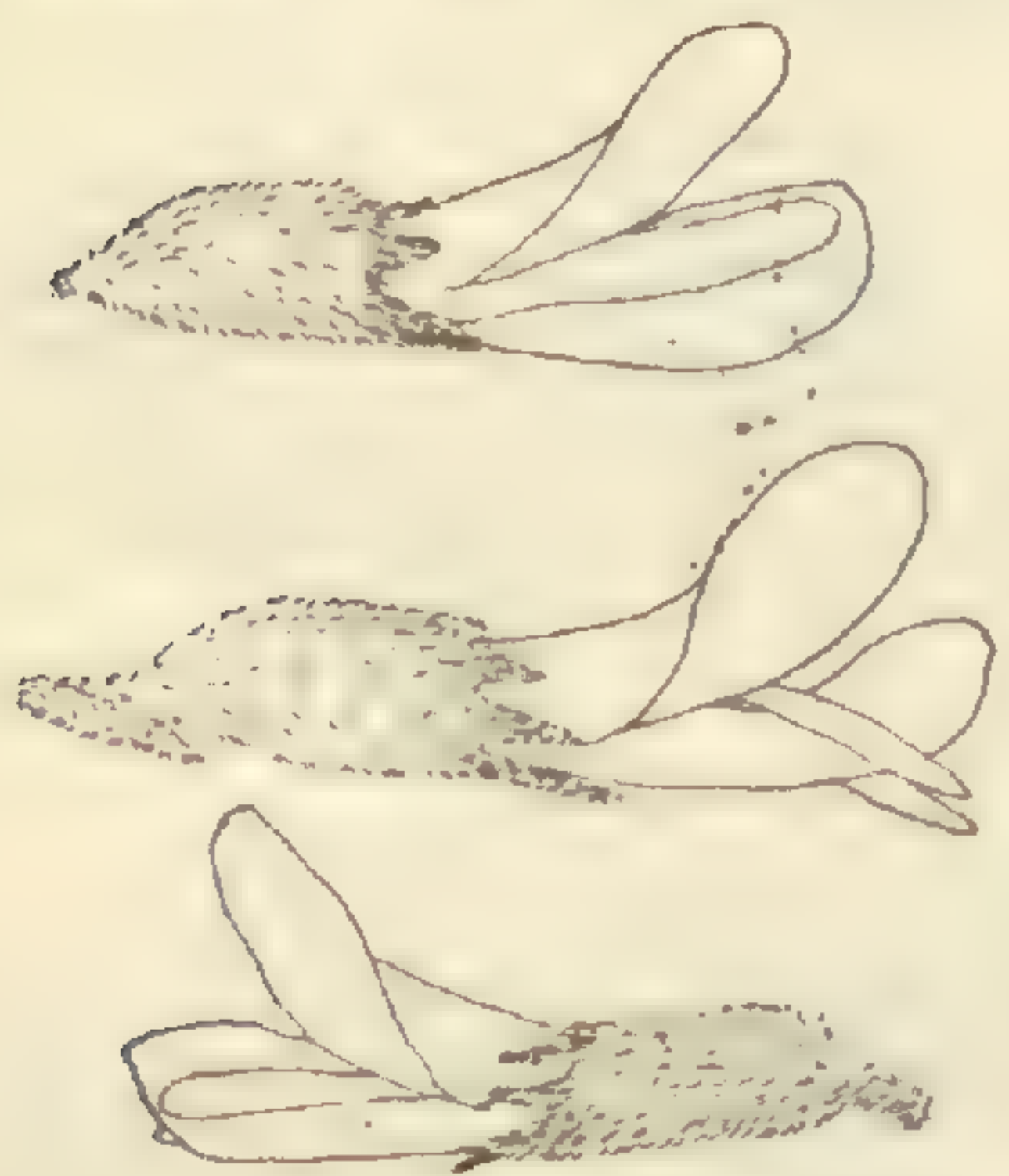
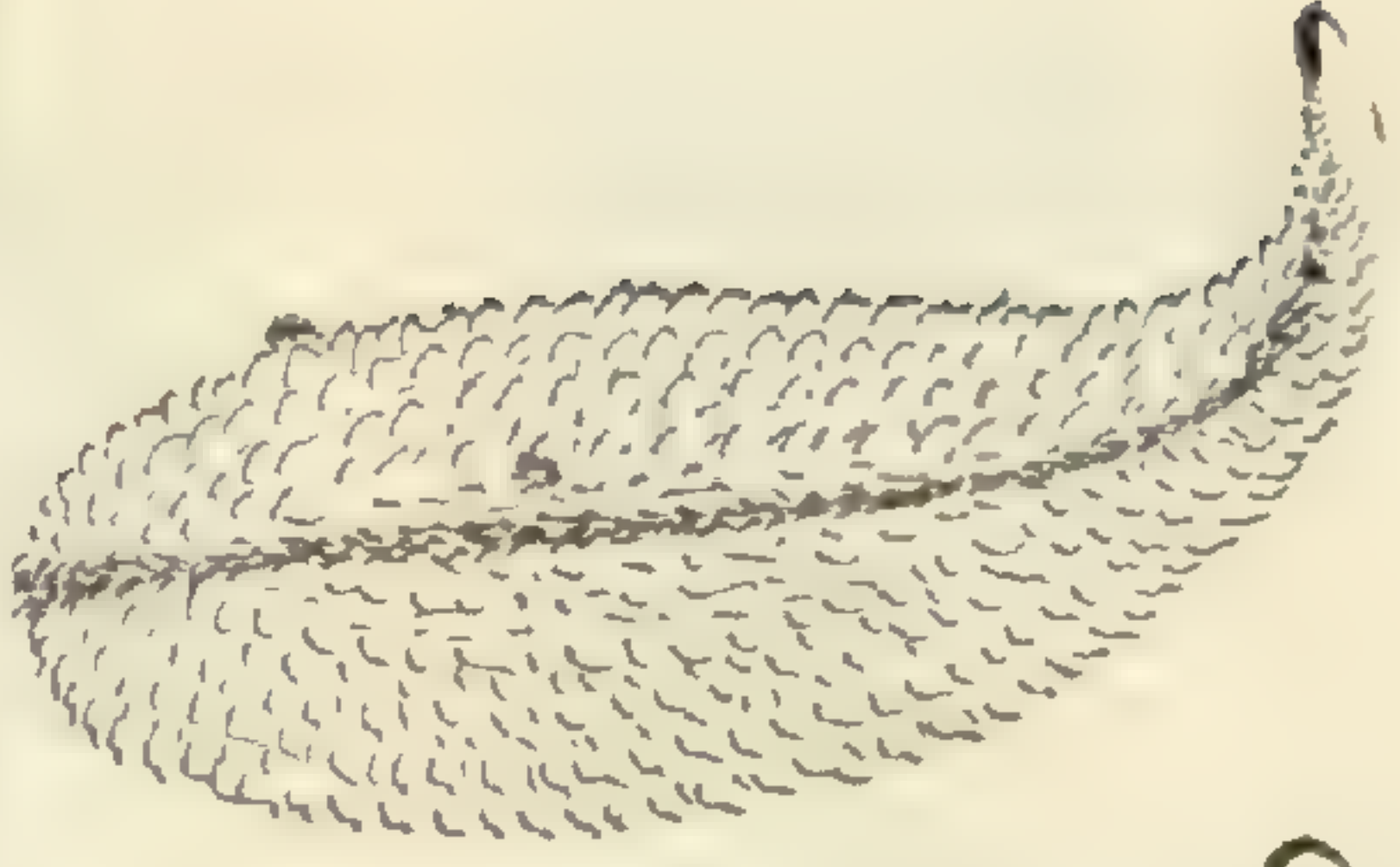
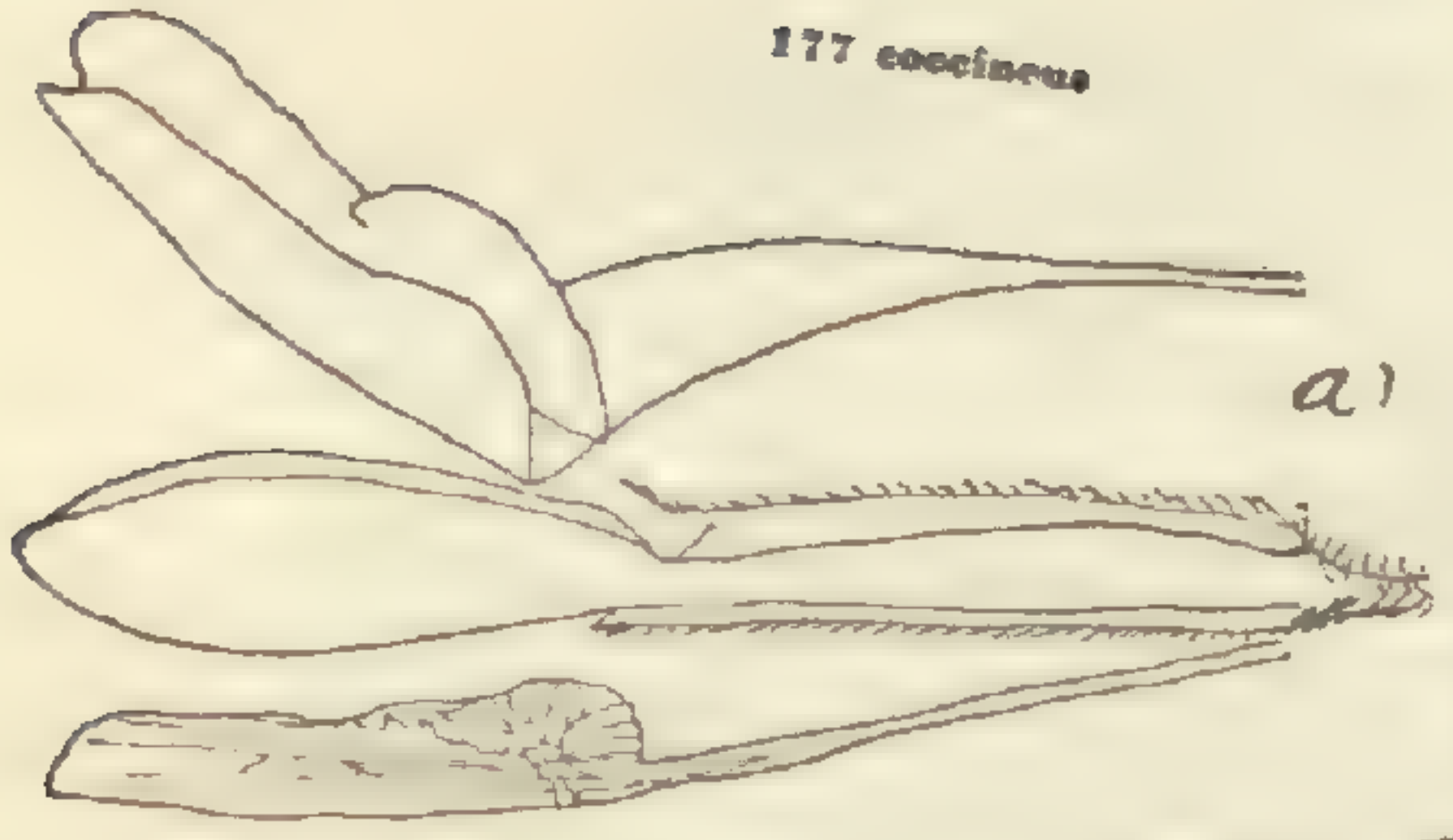
curved a

a
176 Eurekaensis

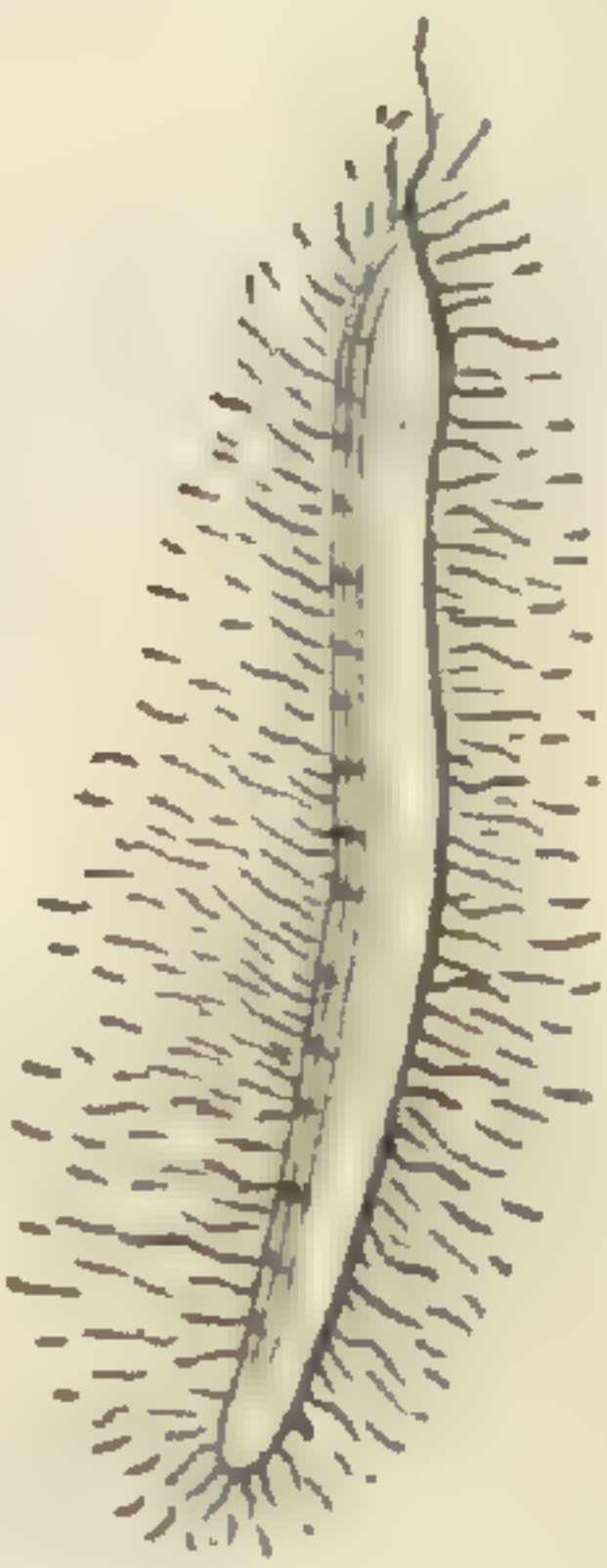
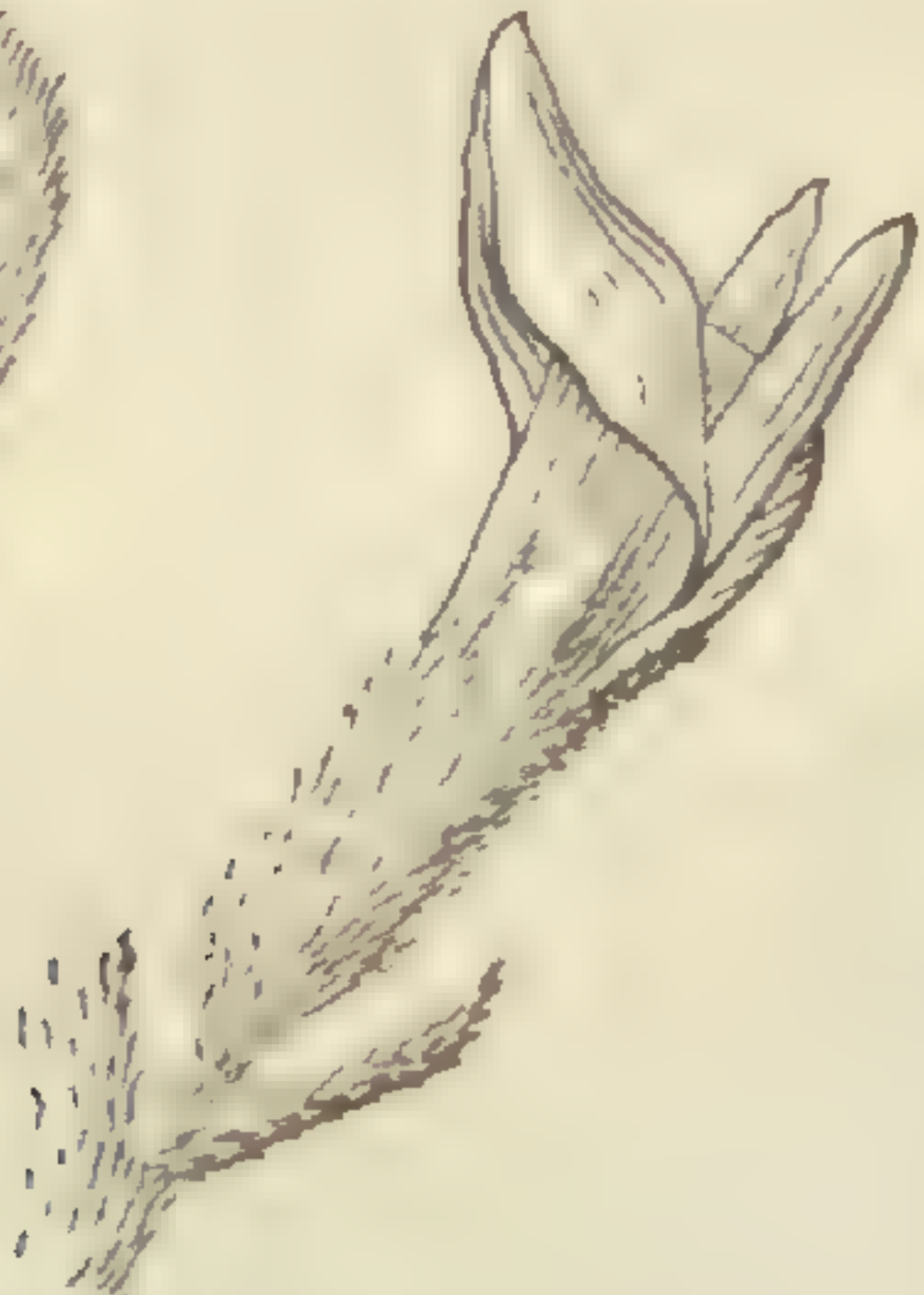
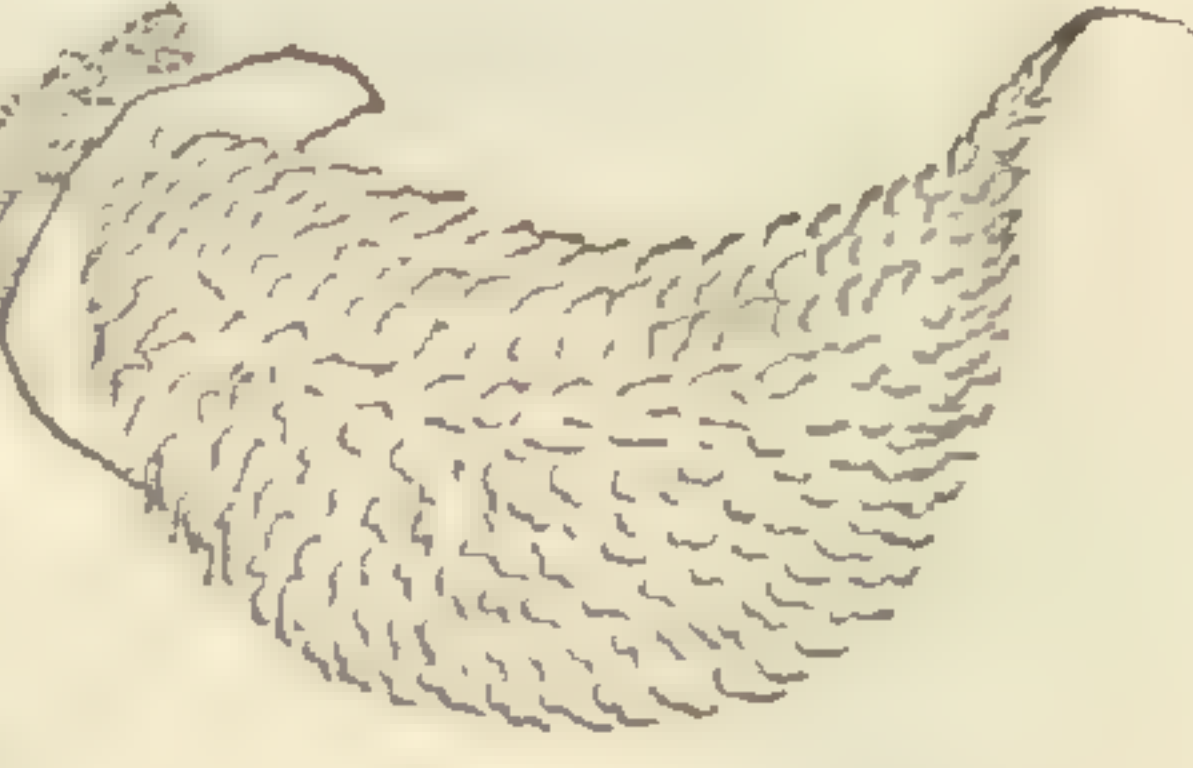
177 coccinea

(53)

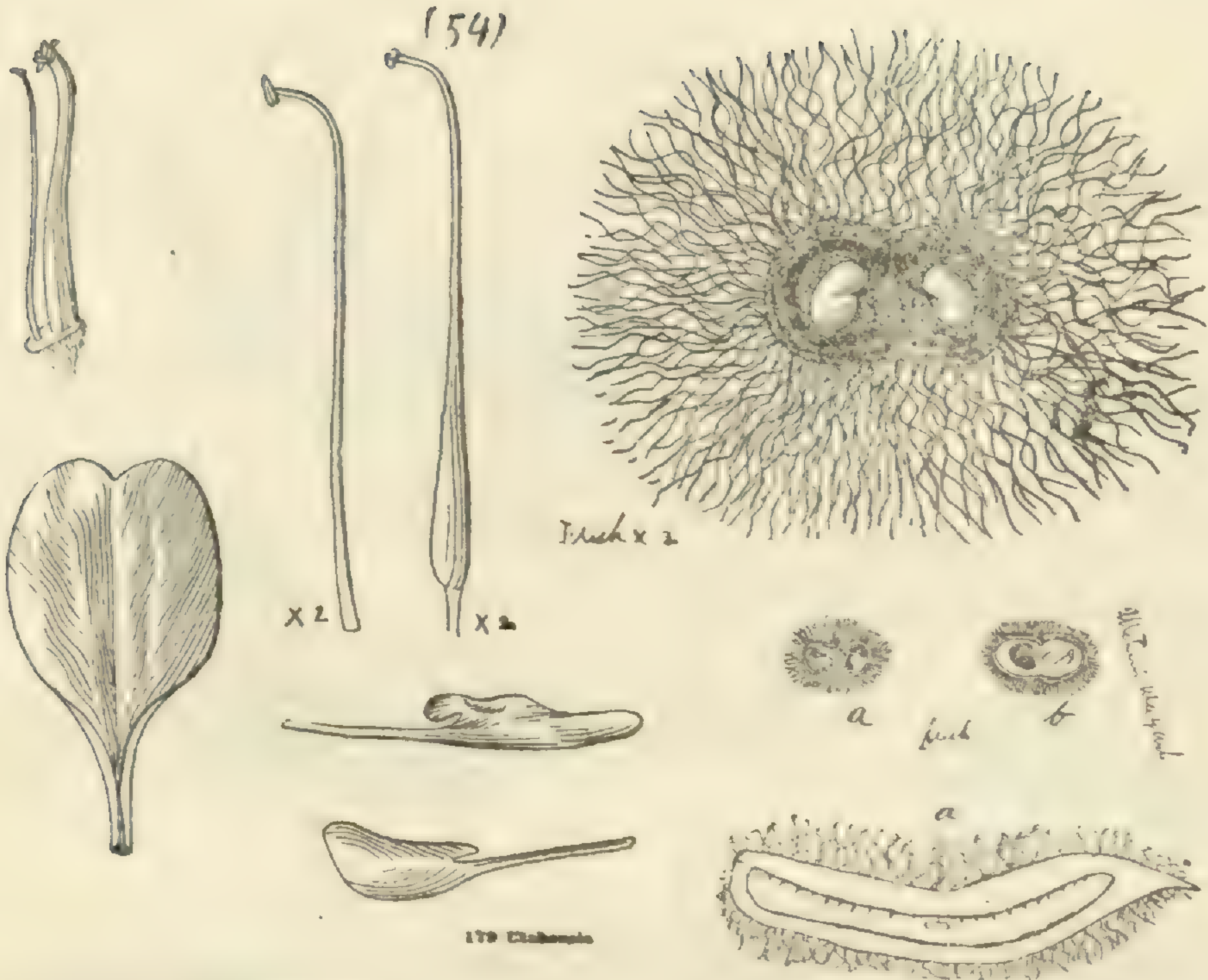
177 coccineus

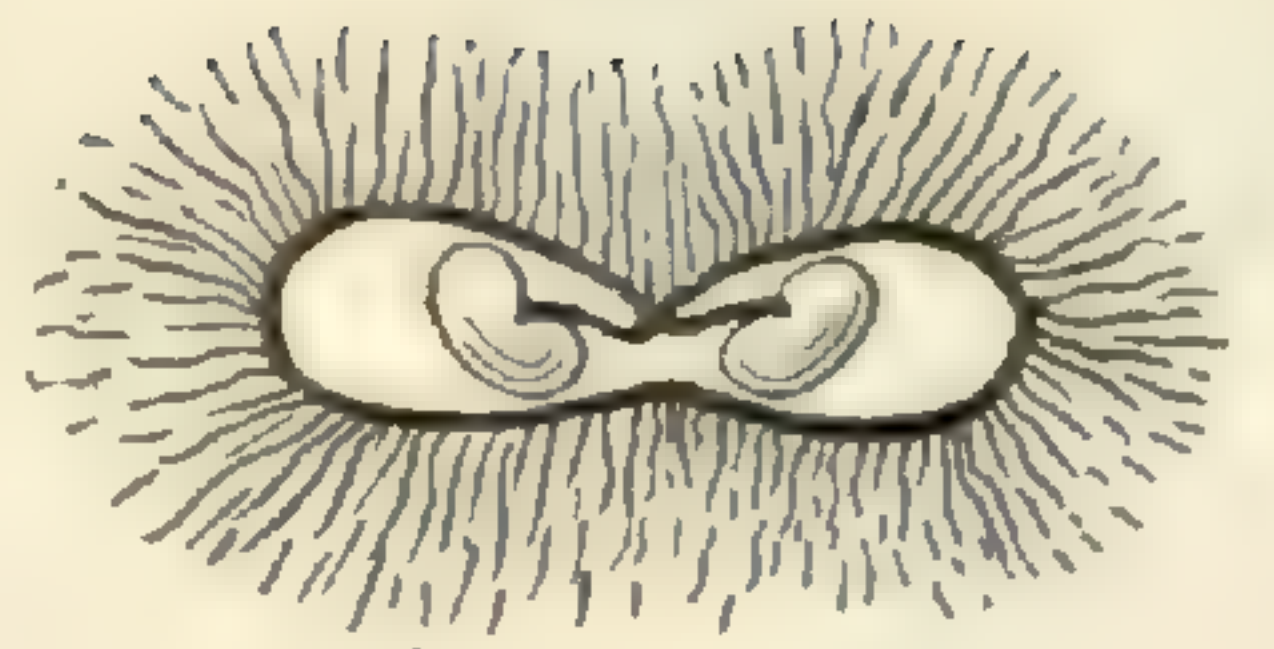


178 fuscus

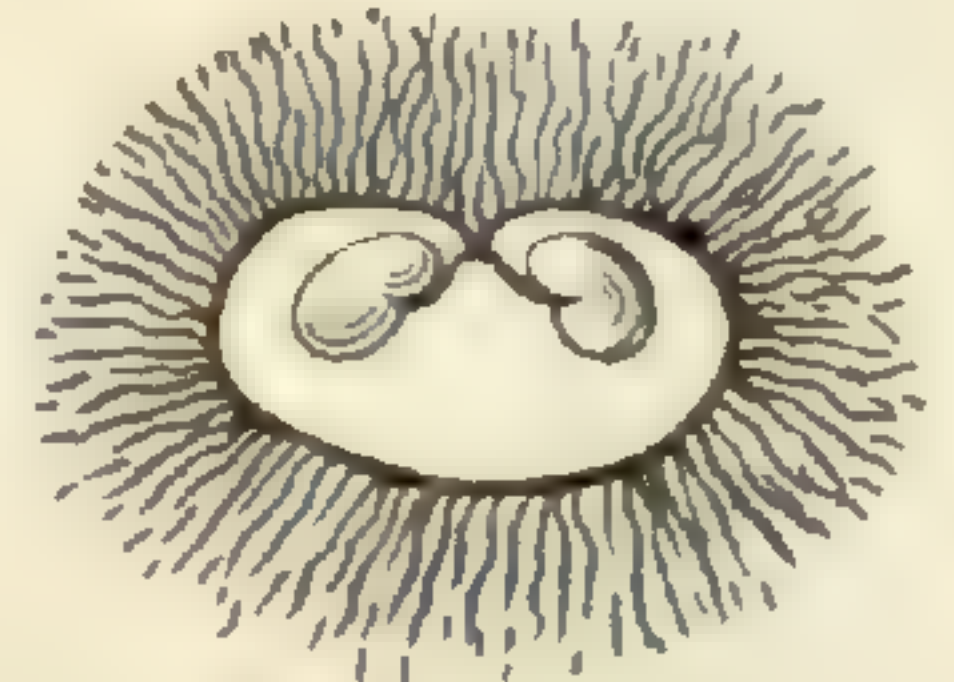
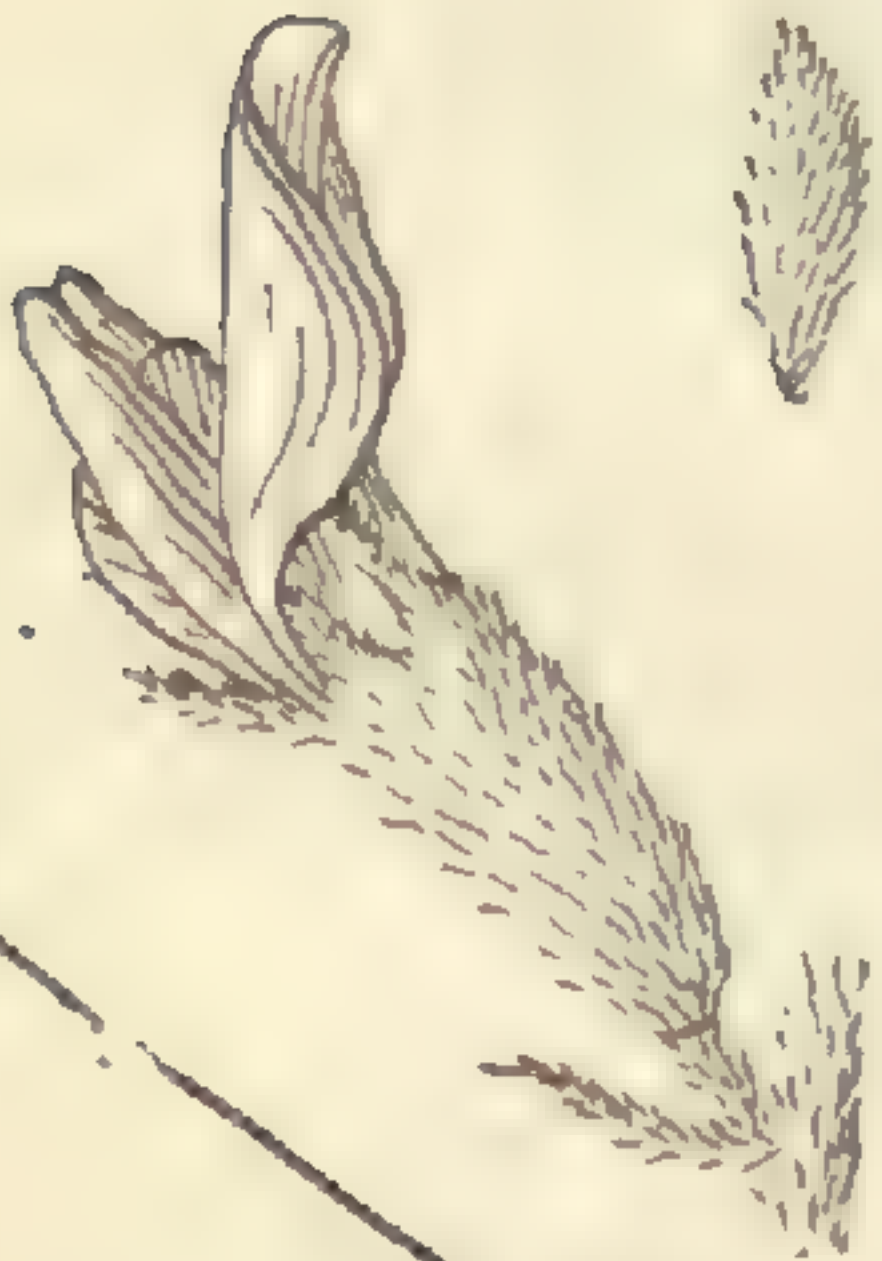


179 Utabensis

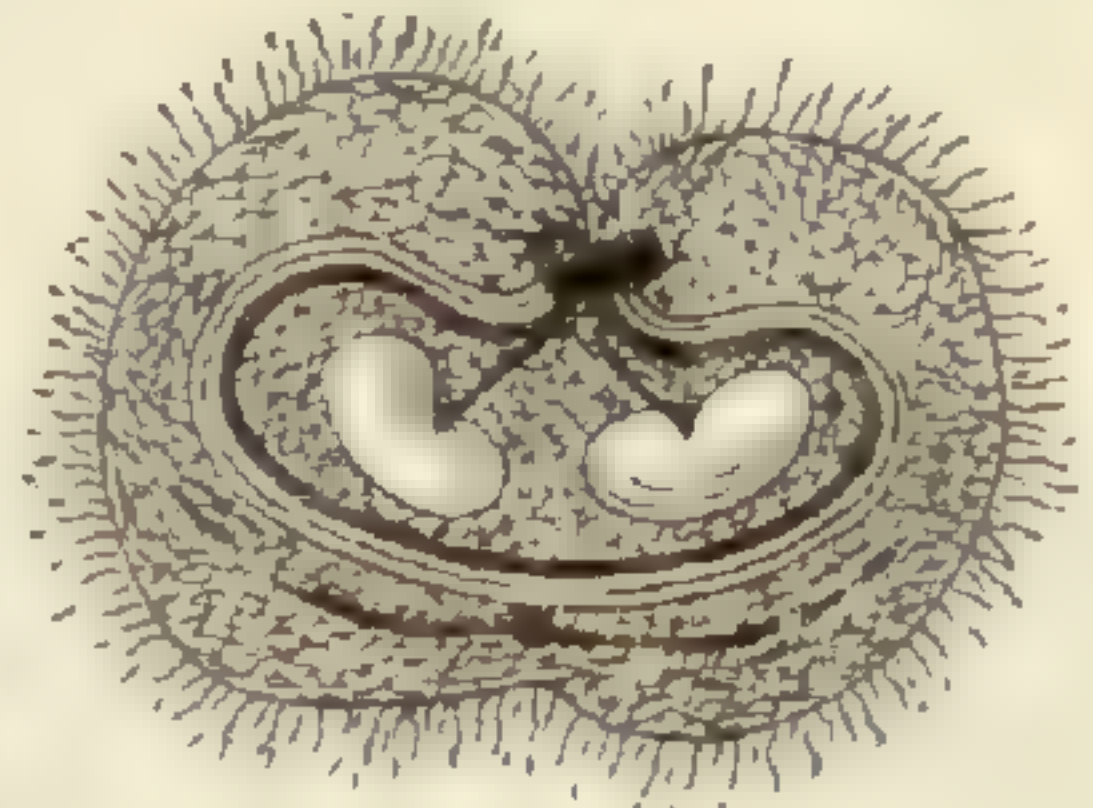
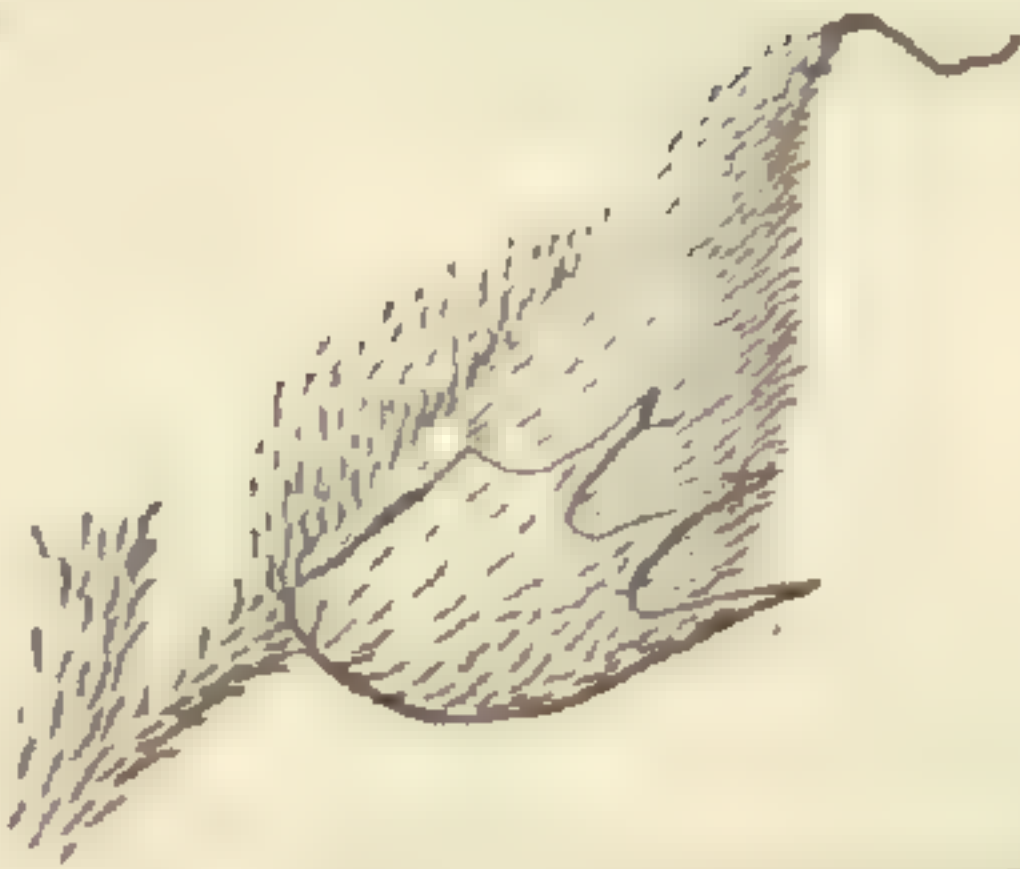




dry x 3
181 Purshii



dry x 2



fresh x 2 1



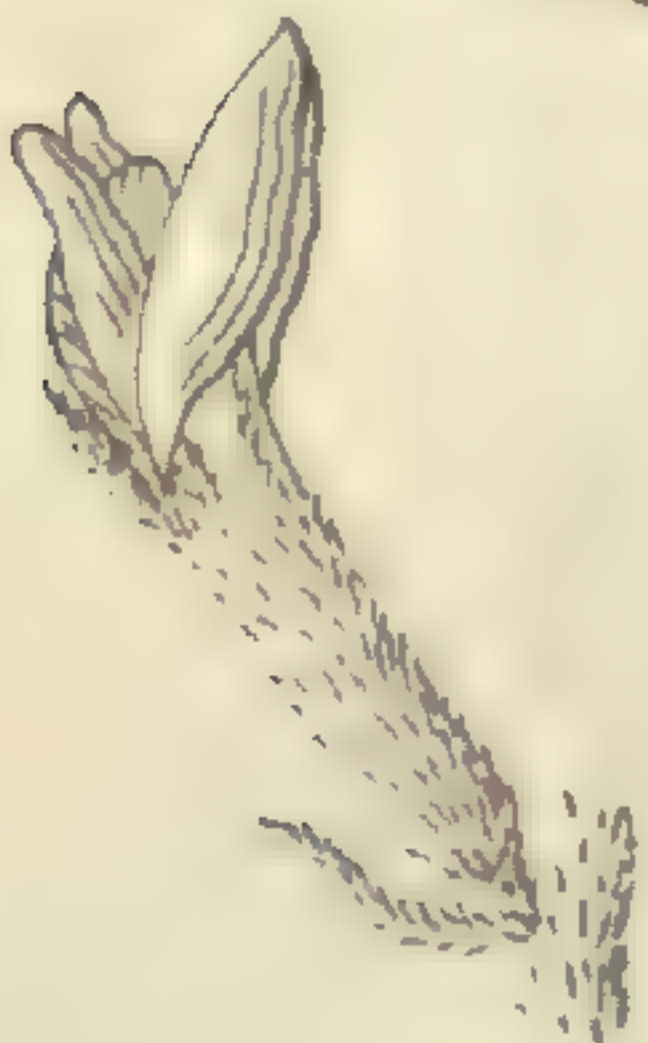
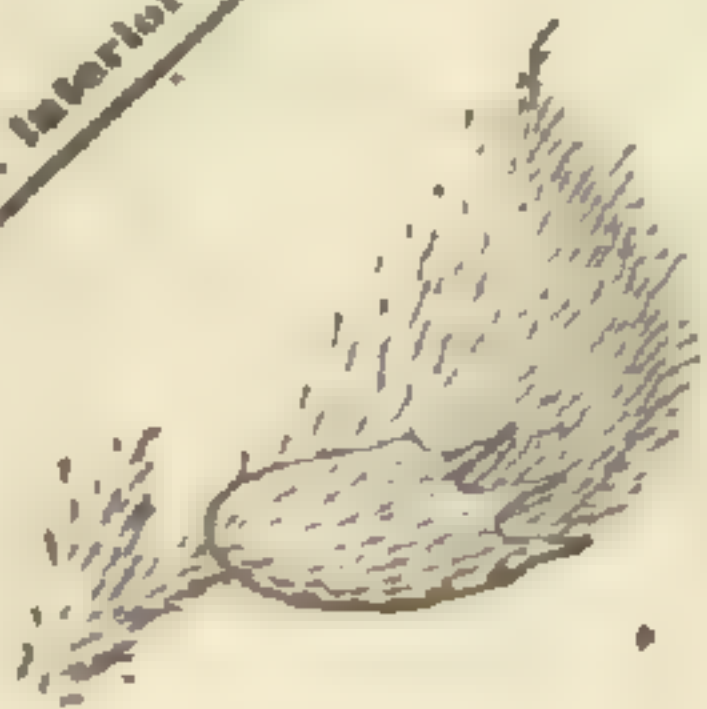
A. Purshii var. leucolobus



dry x 2



Var. laevior



A. Pursh. s. tr. longilobus



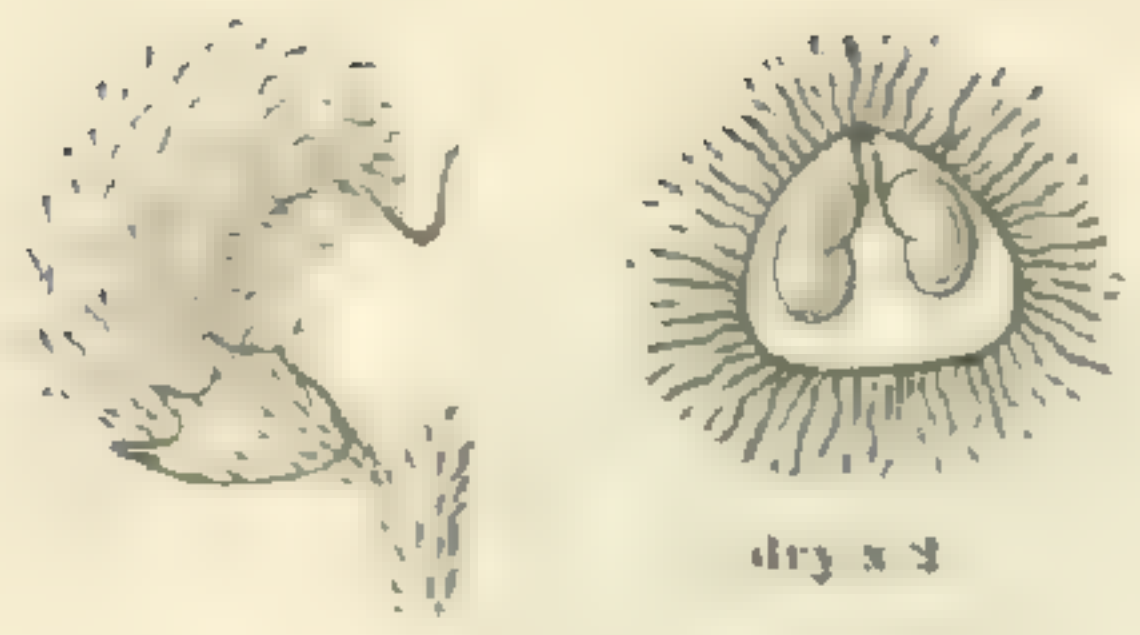
dry x 4



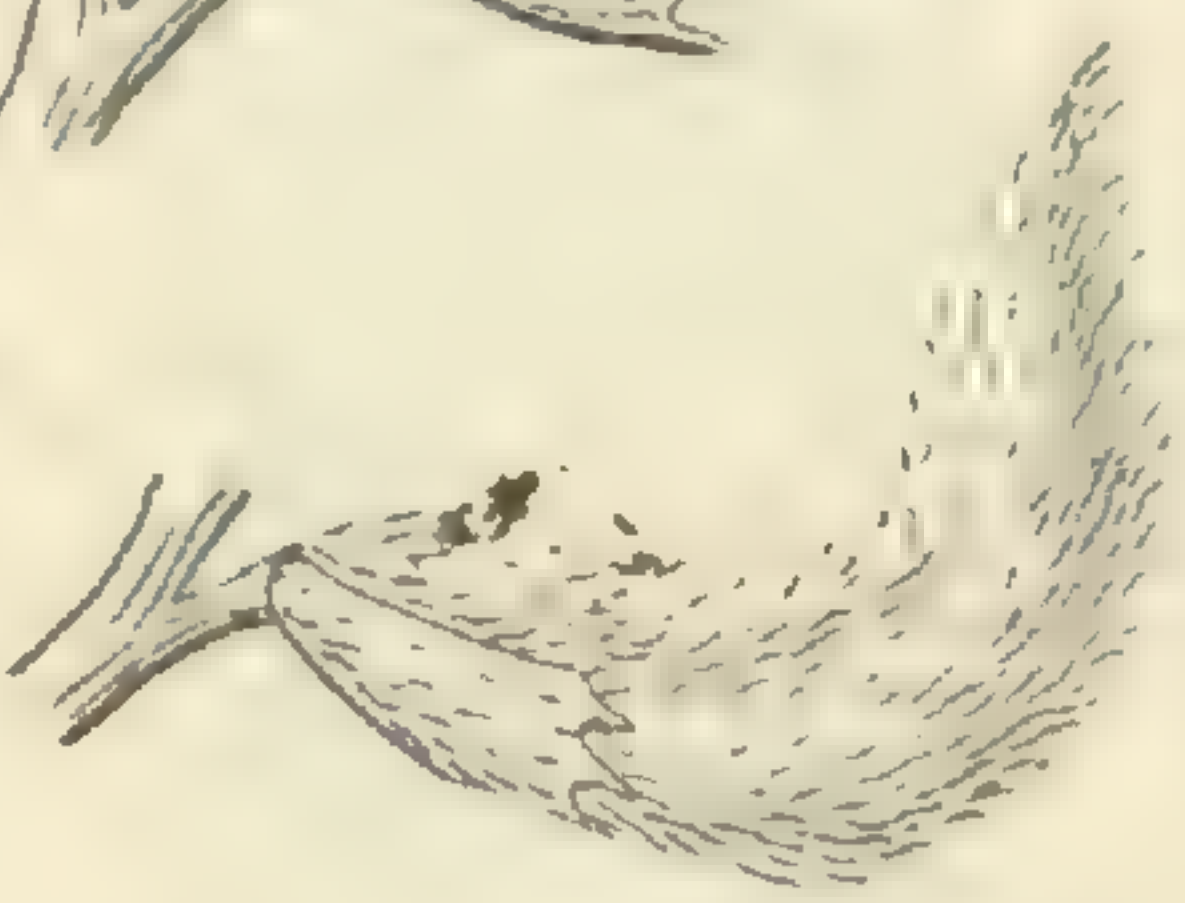
dry x 2

A. Purshii var.

(66)



A. Purshii var.



dry x 2

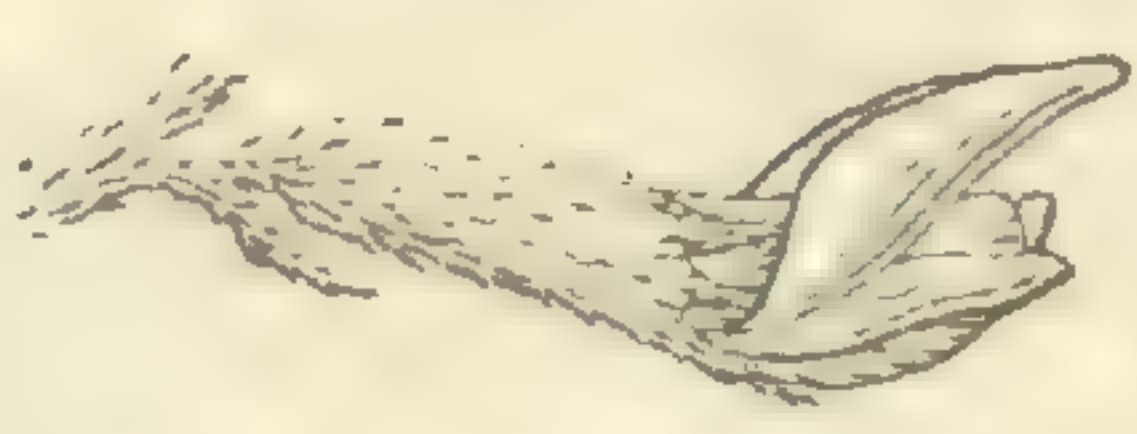


dry x 2



dry x 2

A. Purshii var. lectulus



A. Purshii var. tinetum

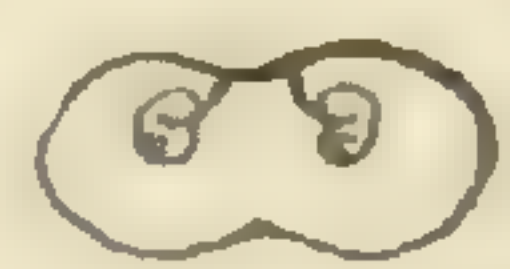
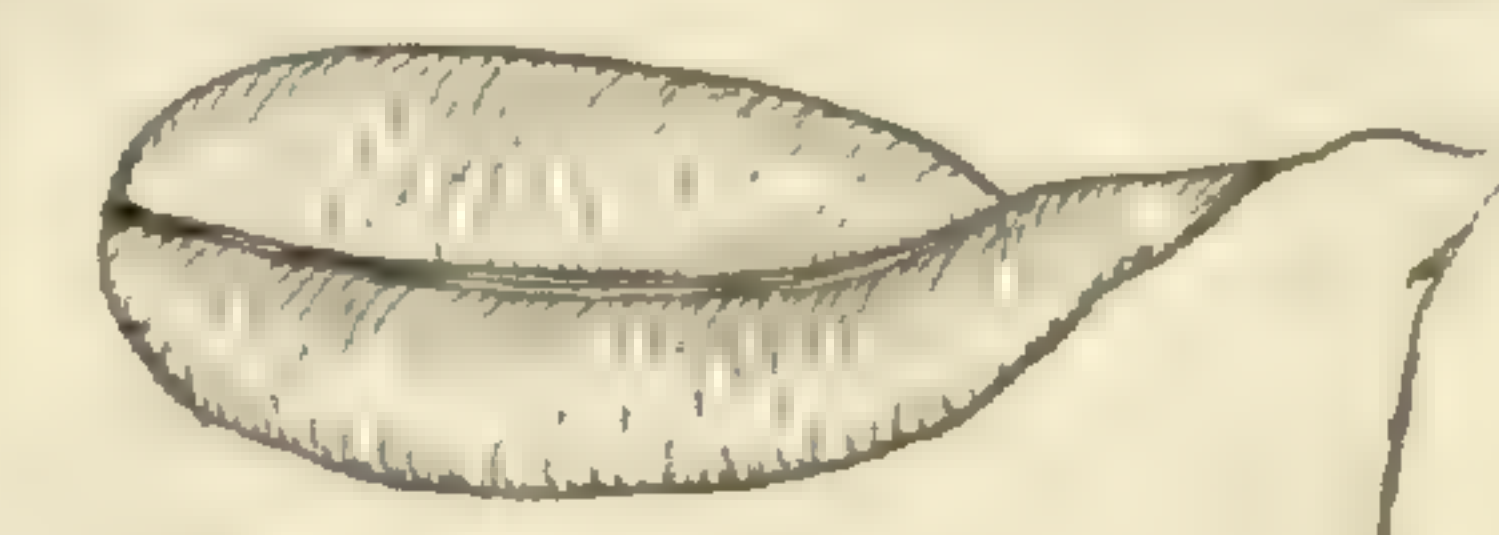
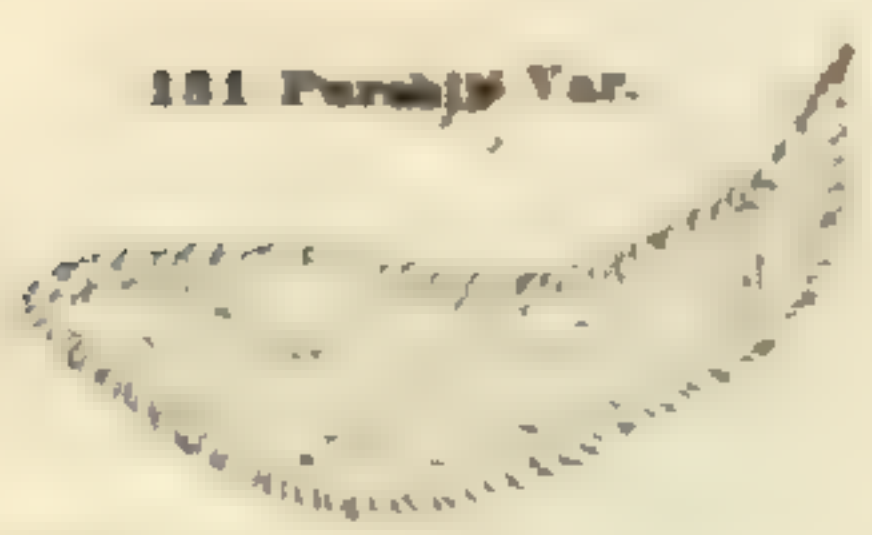
Purshii tinetum



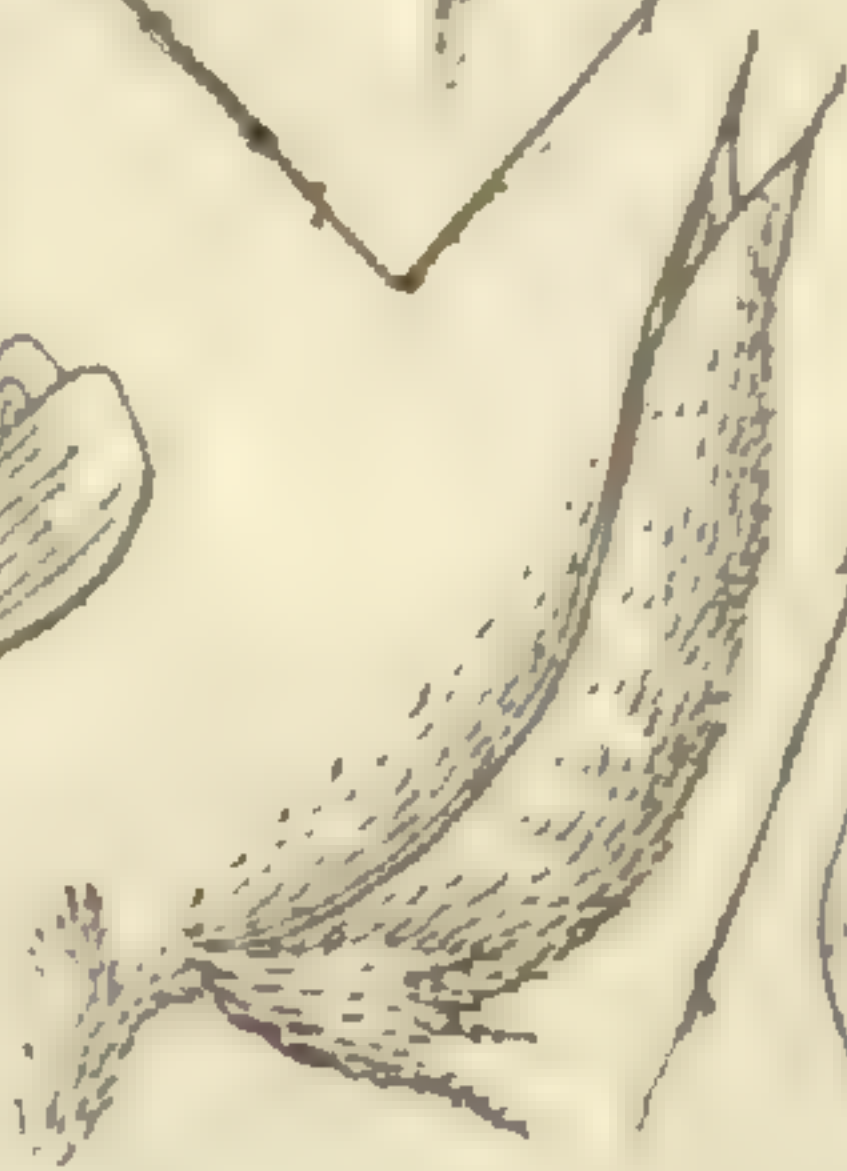
Purshii tinetum



181 Purshii Var.



182 Parryi



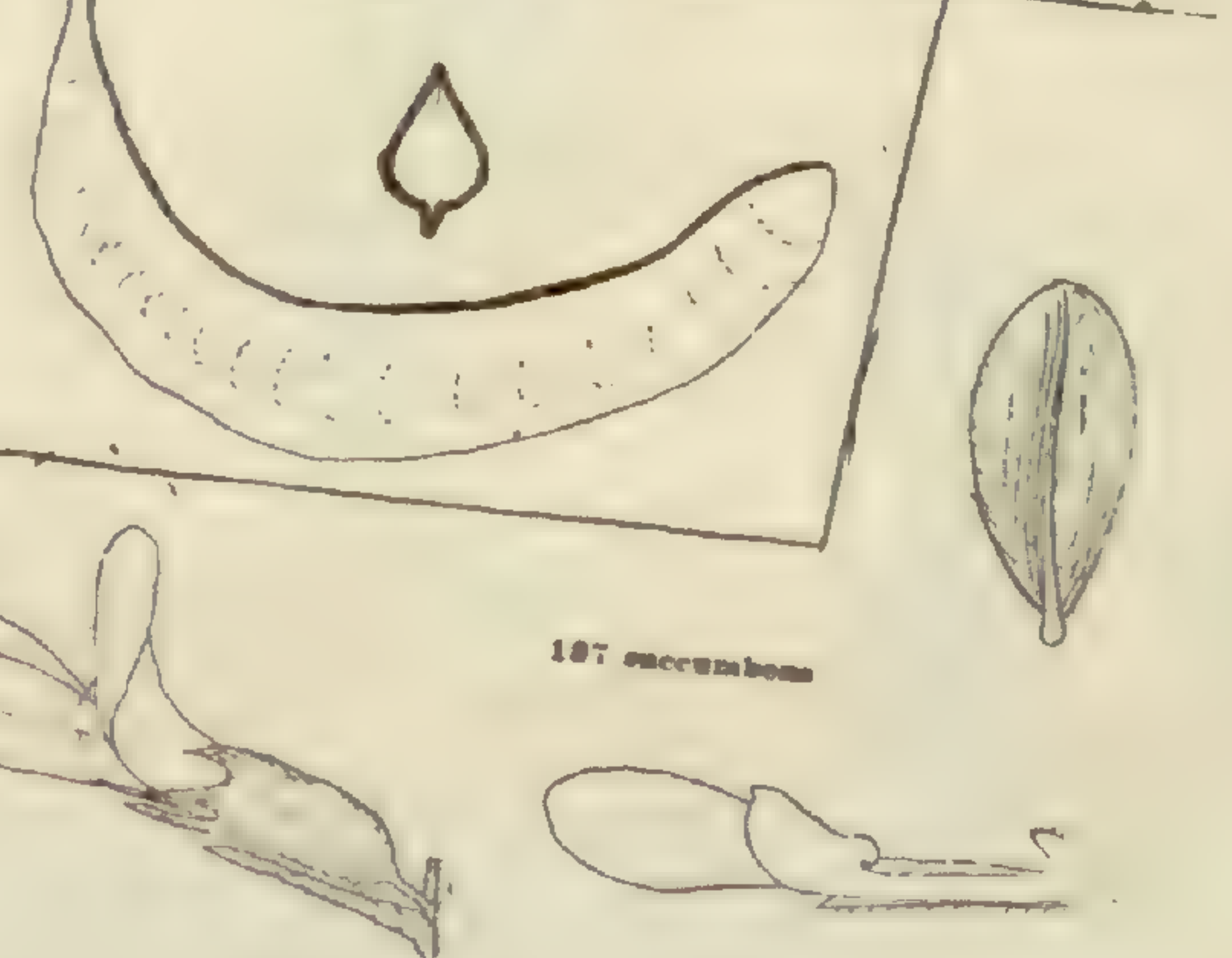
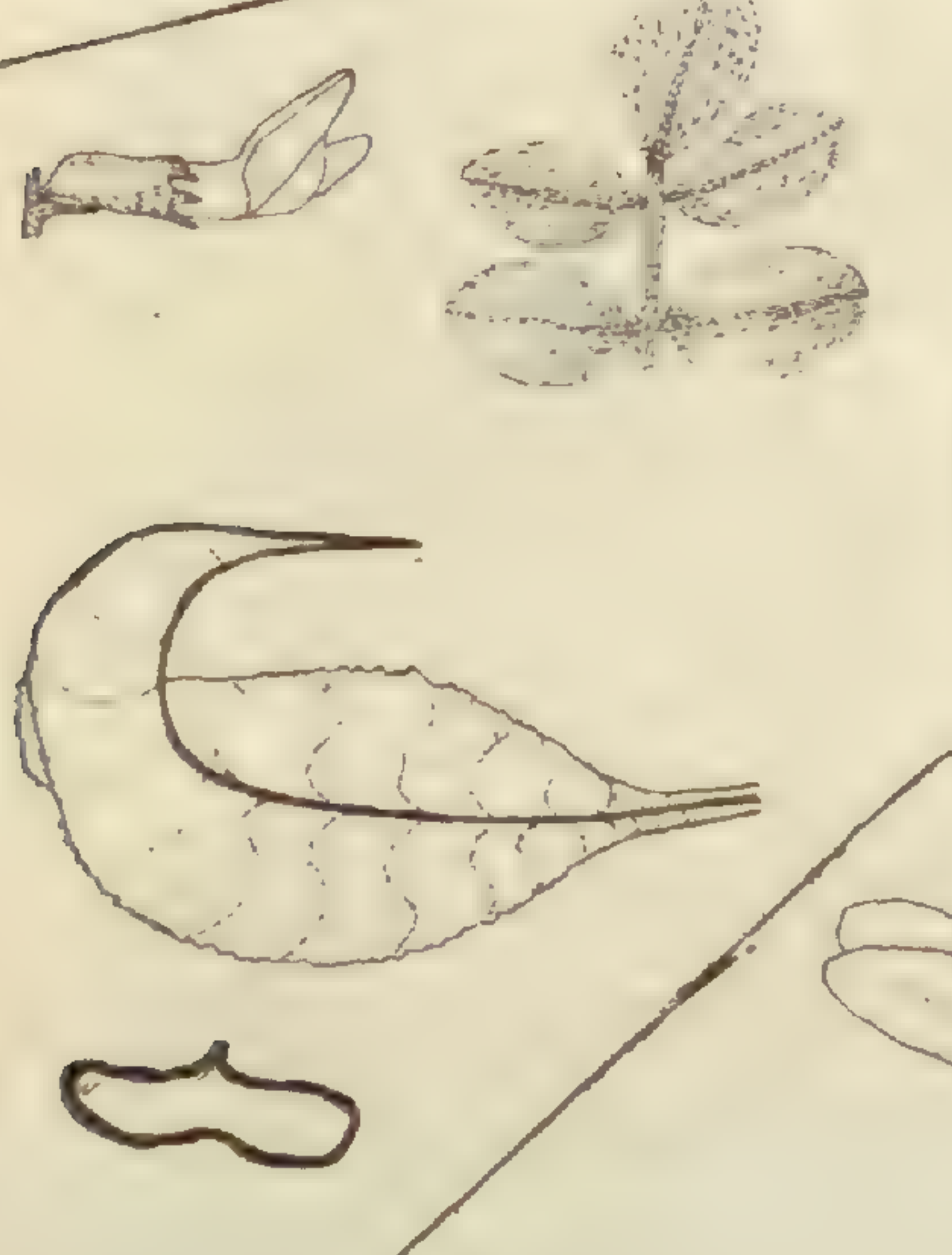
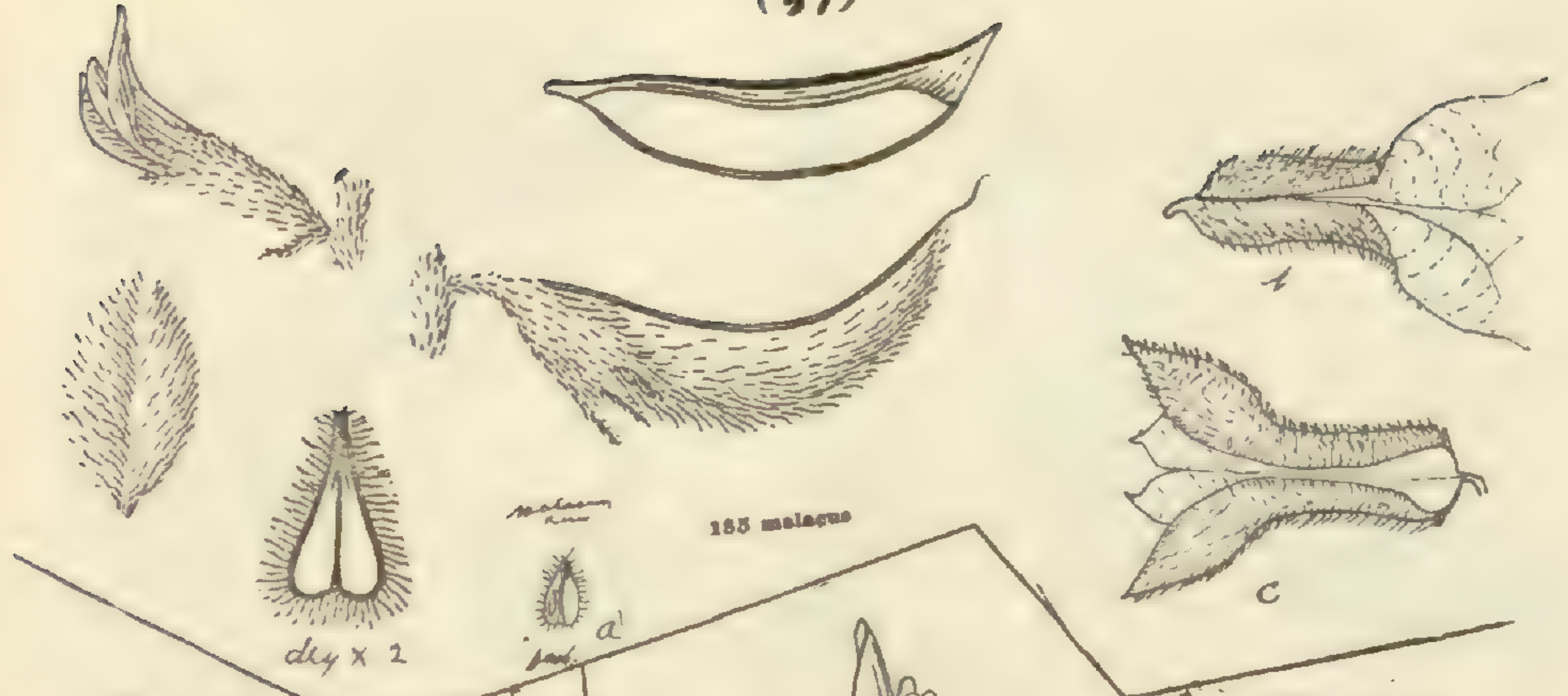
183 Purshii



184 mollis



(57)





178 *decumbens*



dry x 2

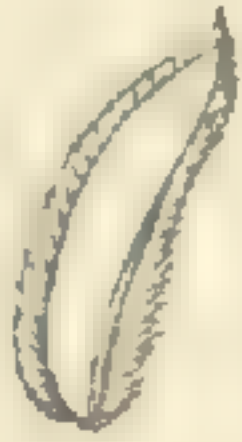


a

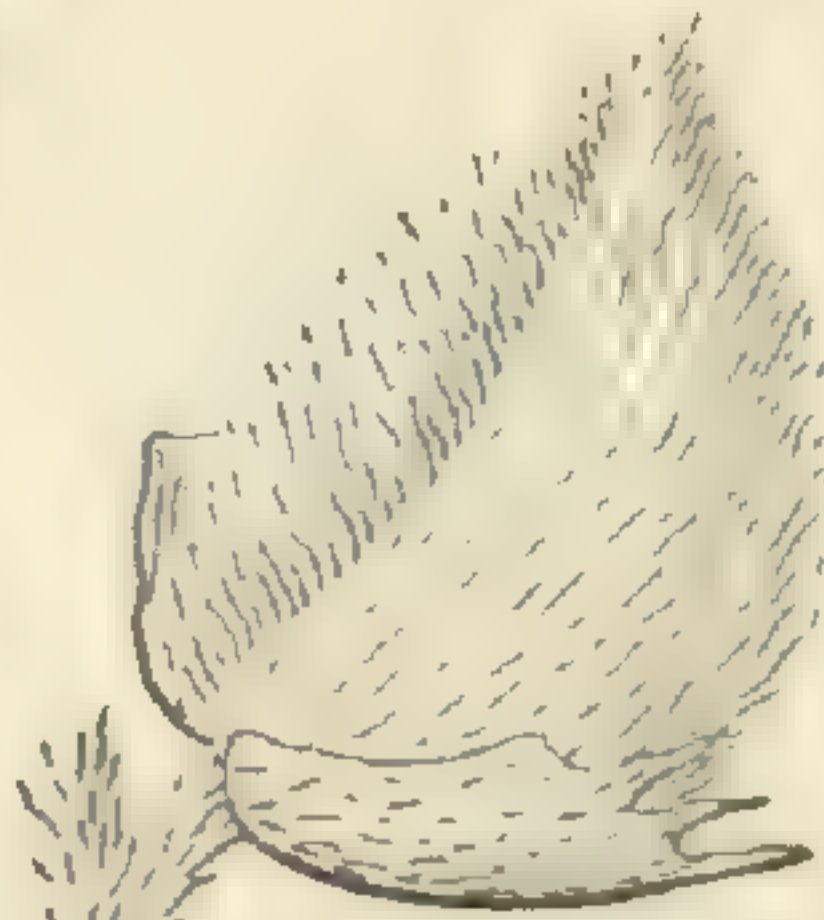
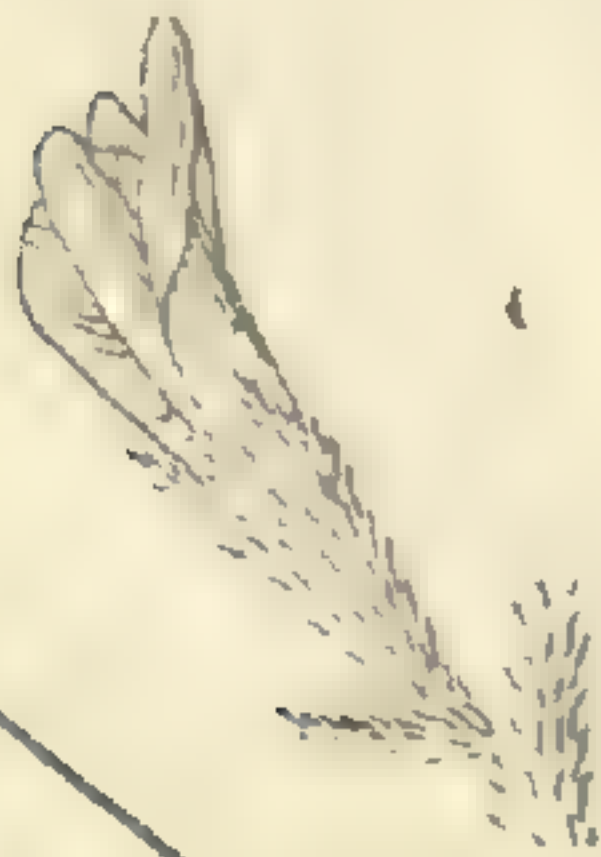


a

dry



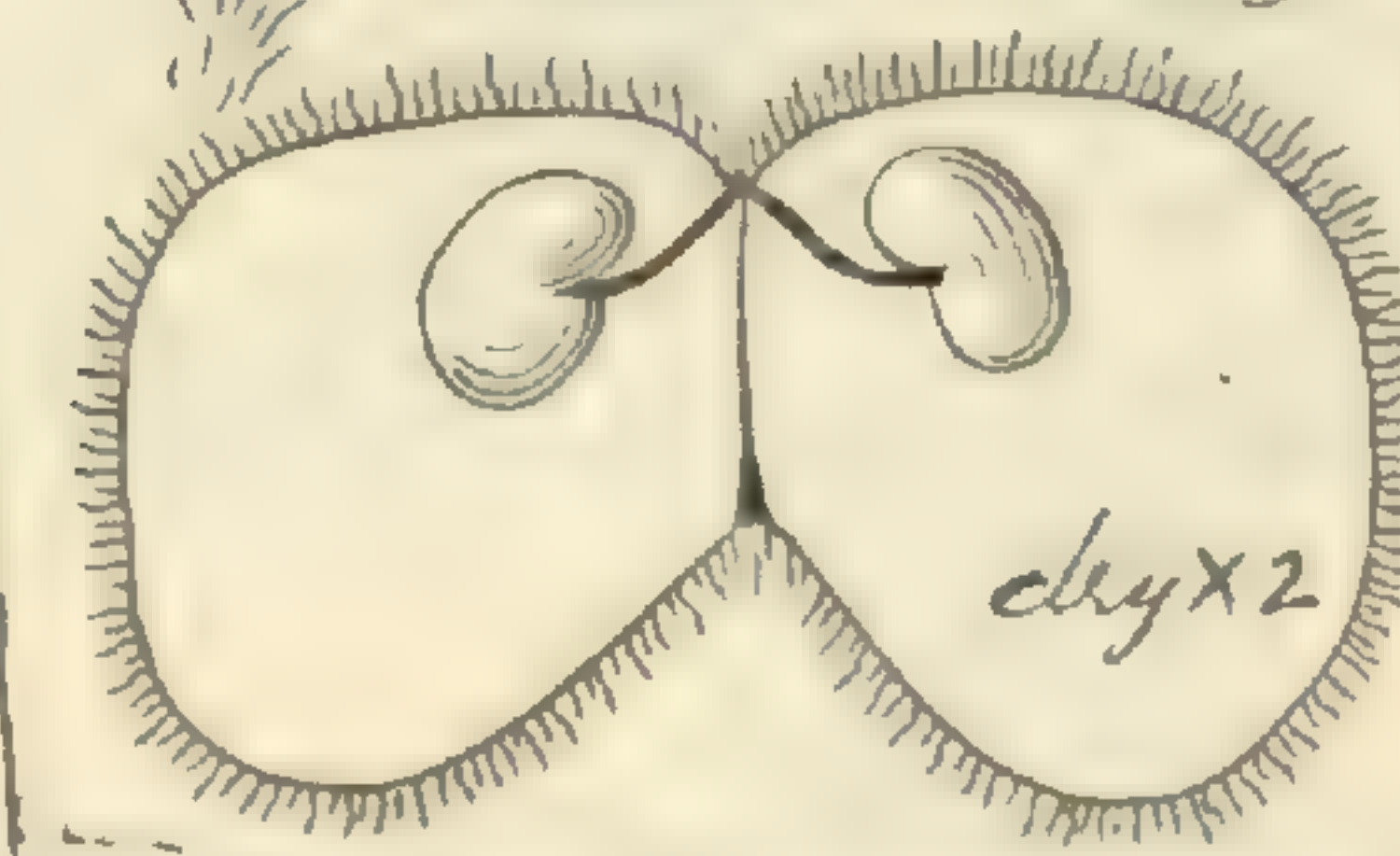
188 *Bigelovii*



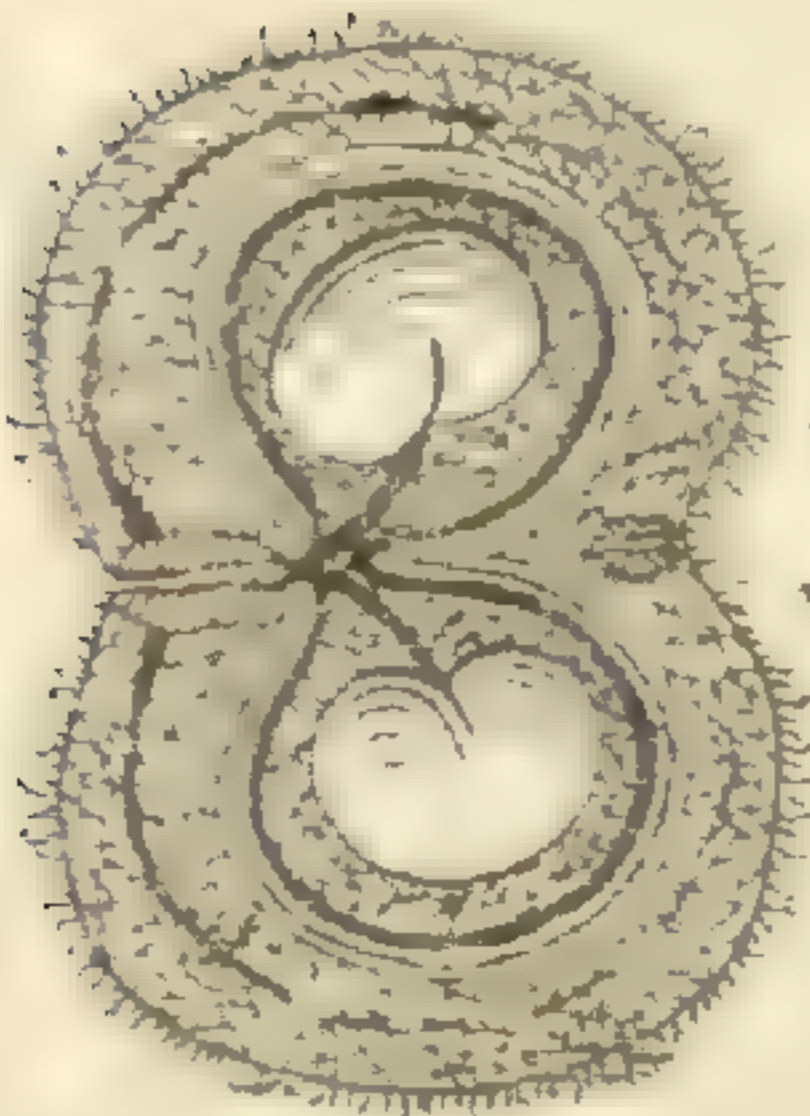
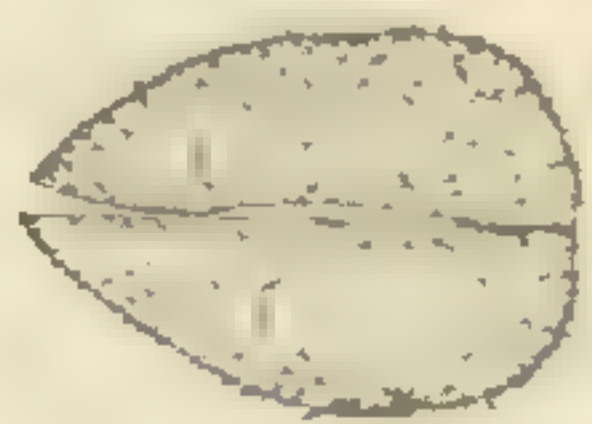
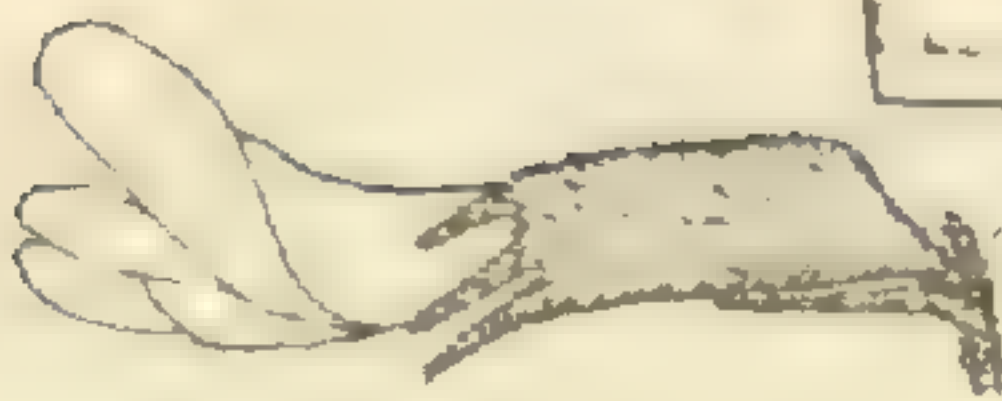
Var. *Matthewsii*



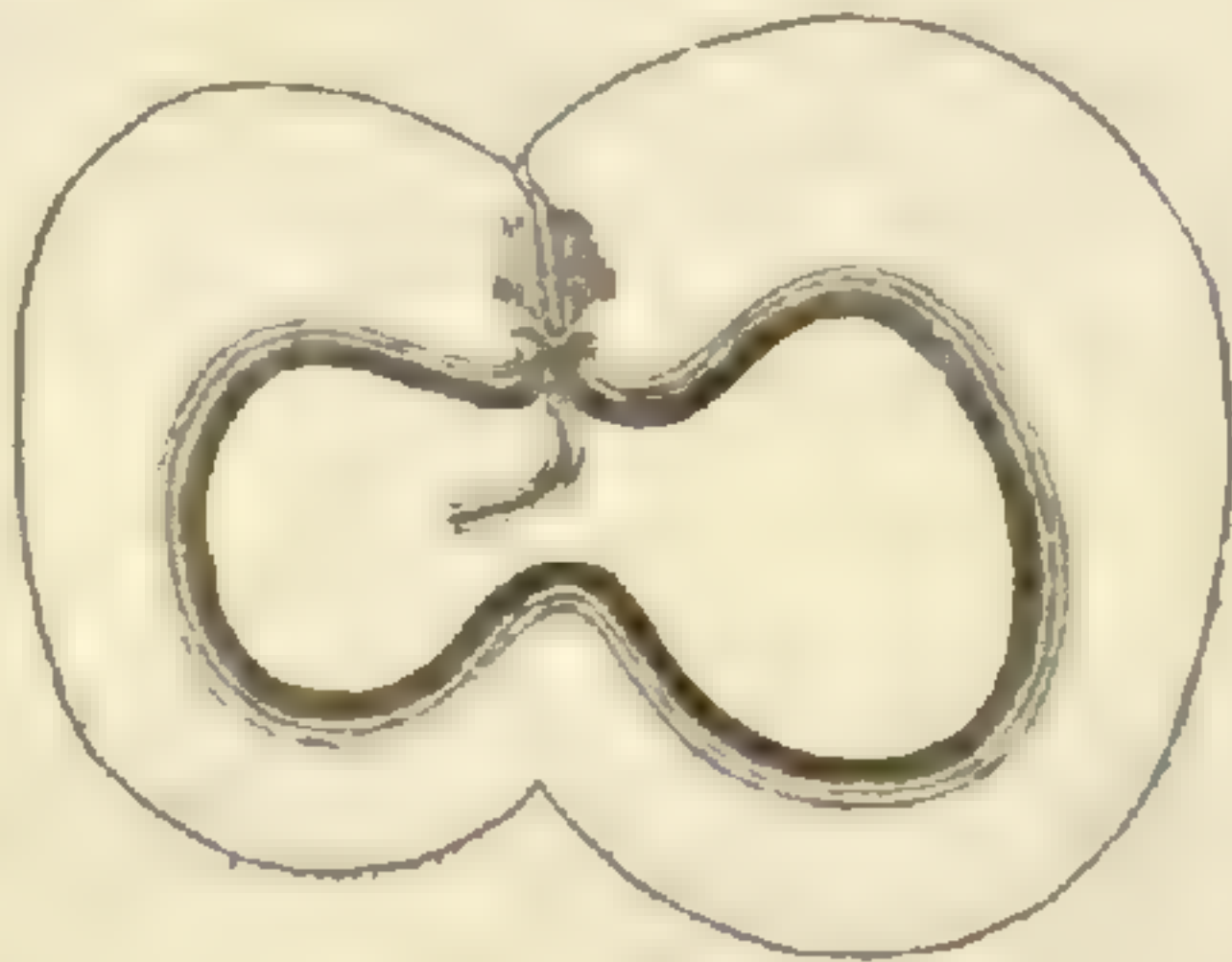
d



dry x 2



dry x 2



BIGELOVII VAR. *THOMPSONAE*
UPPER END SECTION X 2



(59)



189 Phacelia



190 Humboldtii



X 2



191 mollaninus Fresh X 2



192 gigantea



Var. Jaquilanae



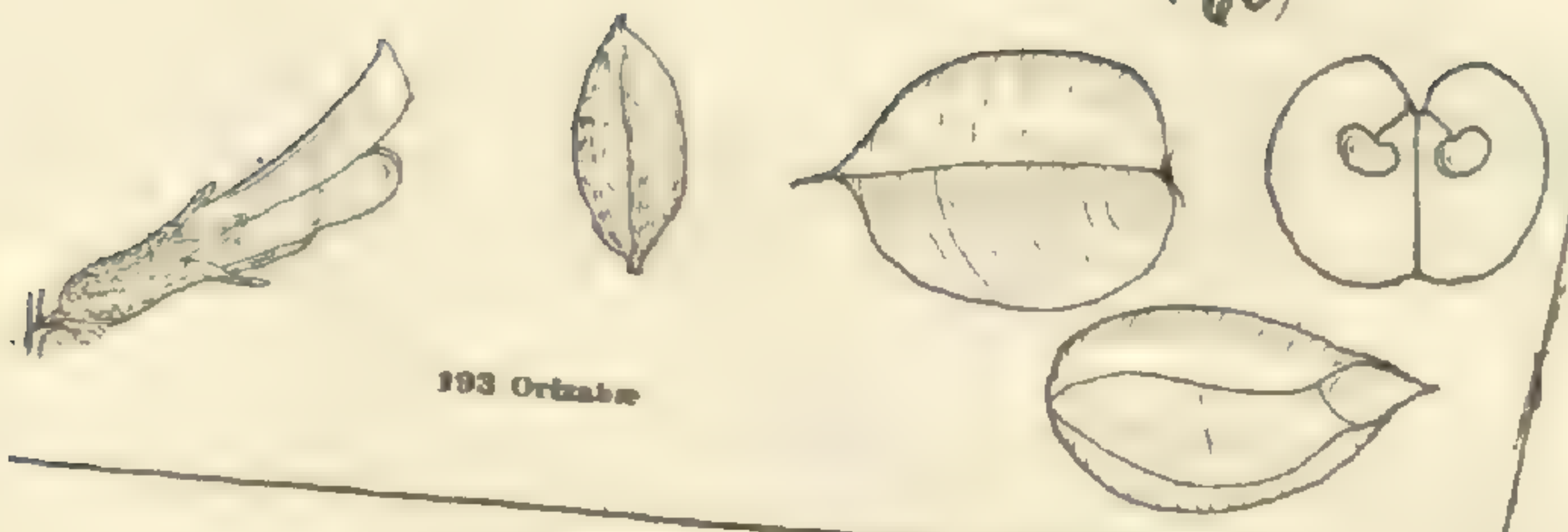
X 2



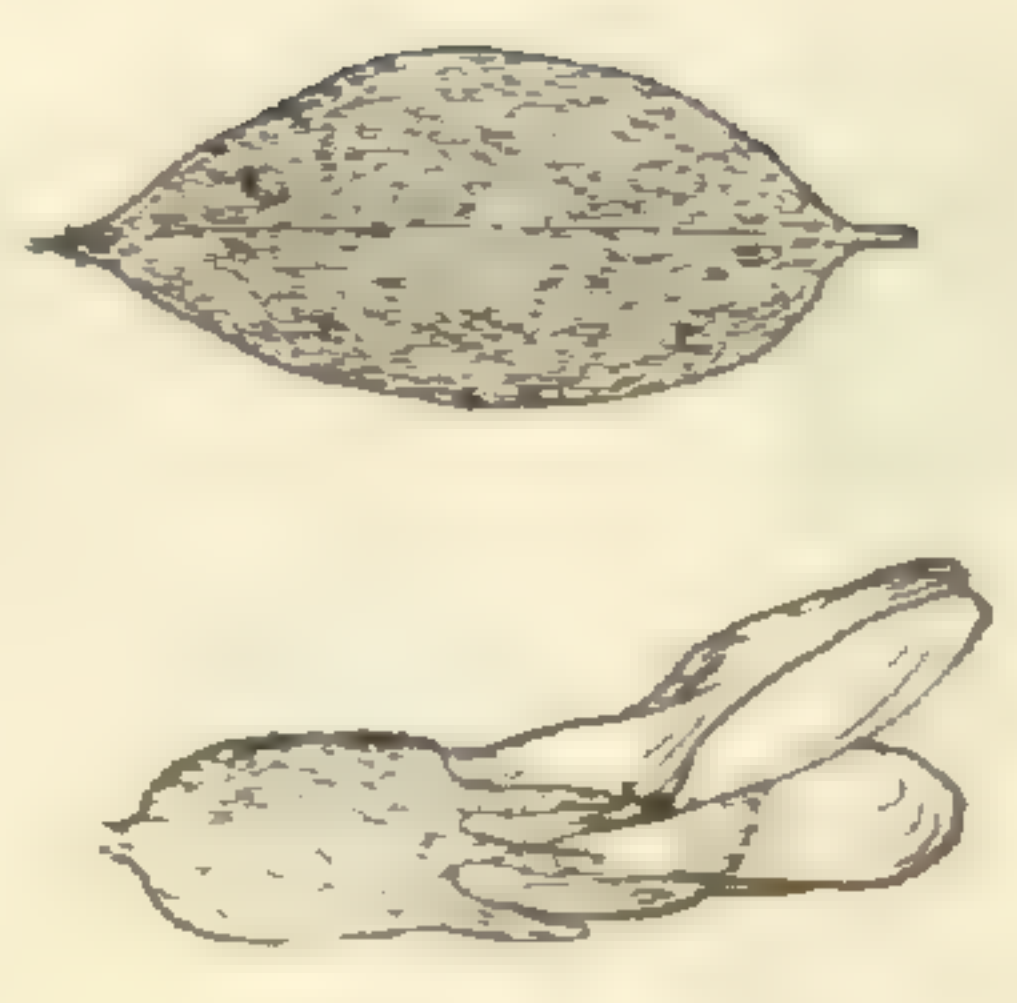
193 Ortobia



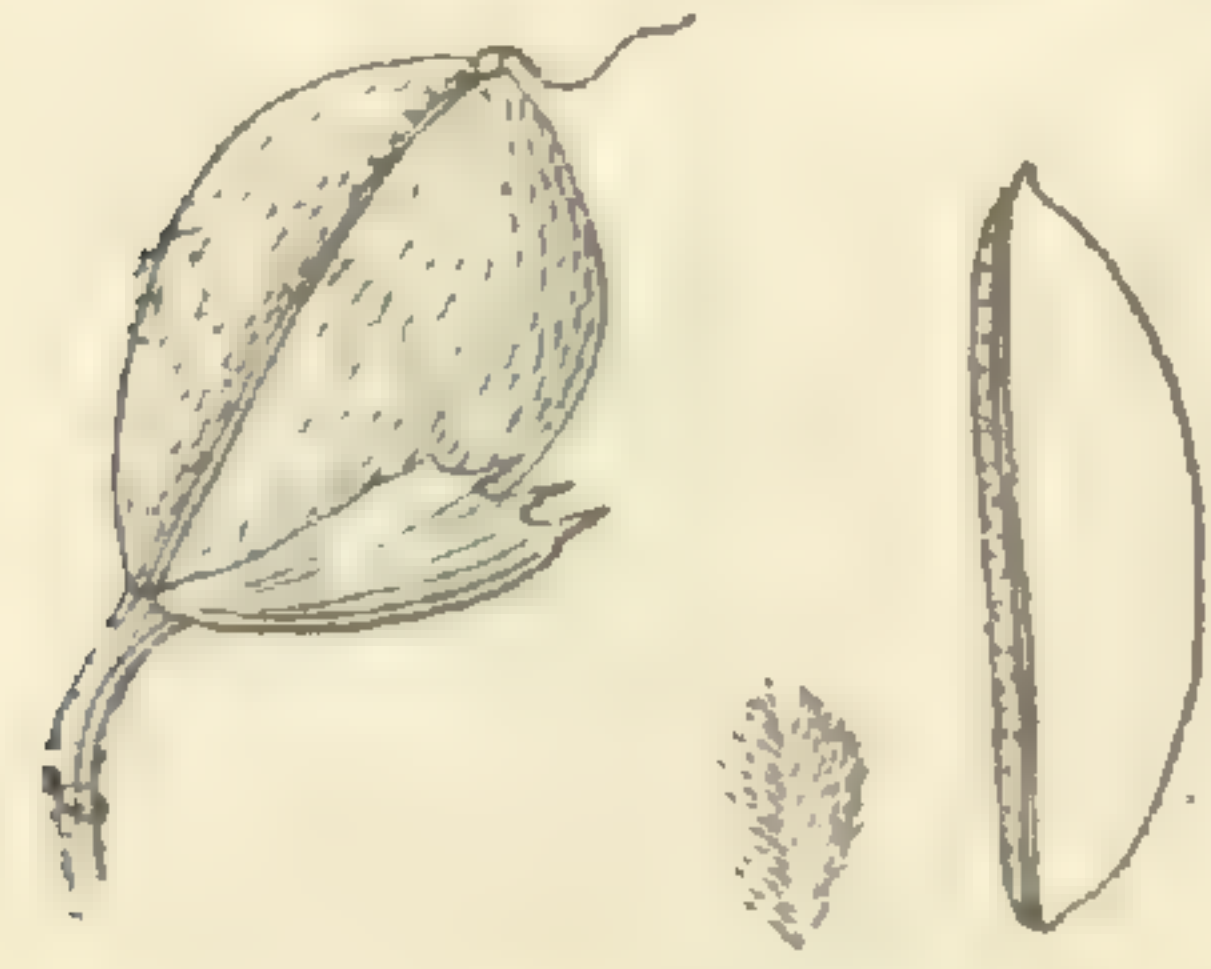
160



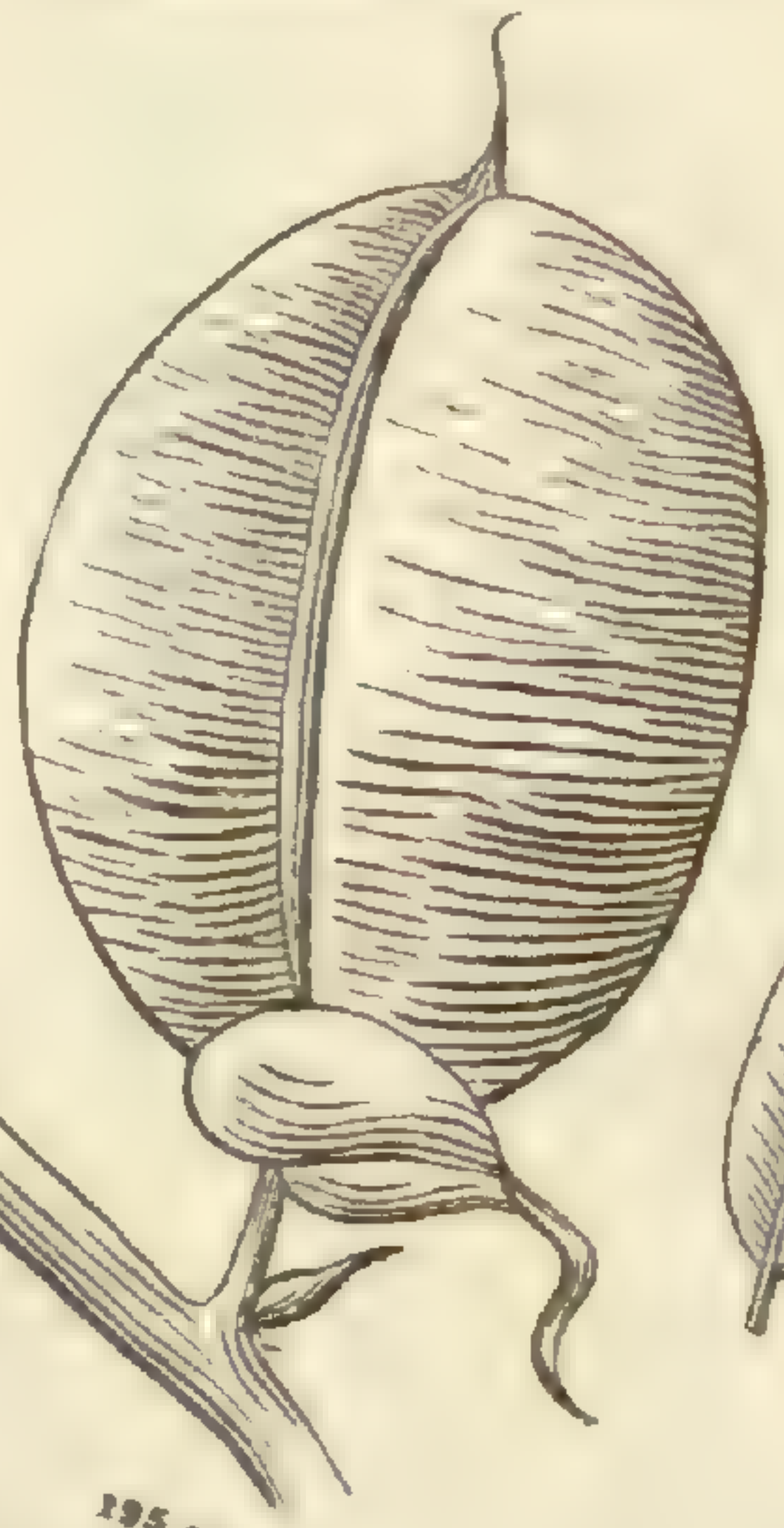
193 Ortziaba



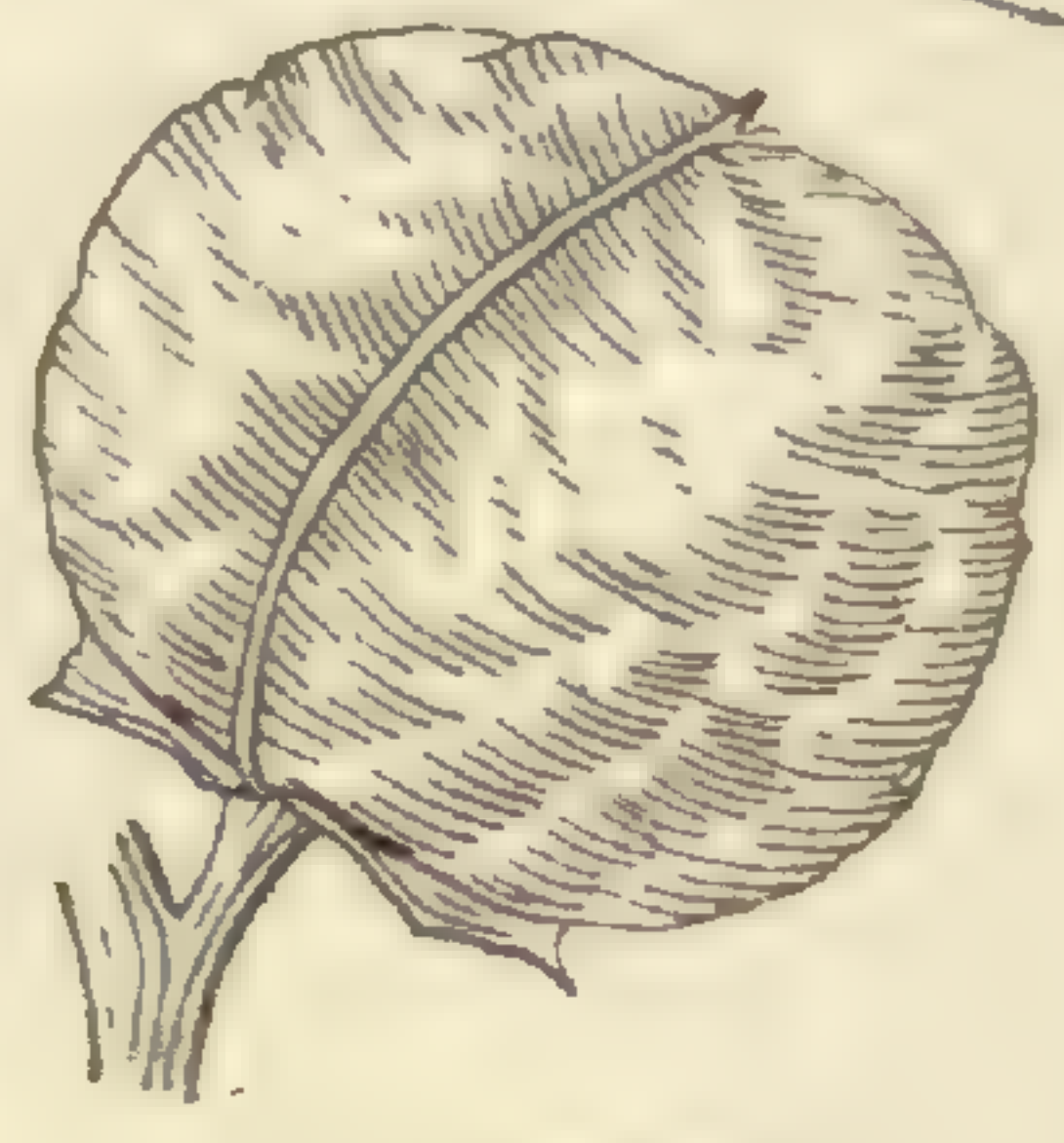
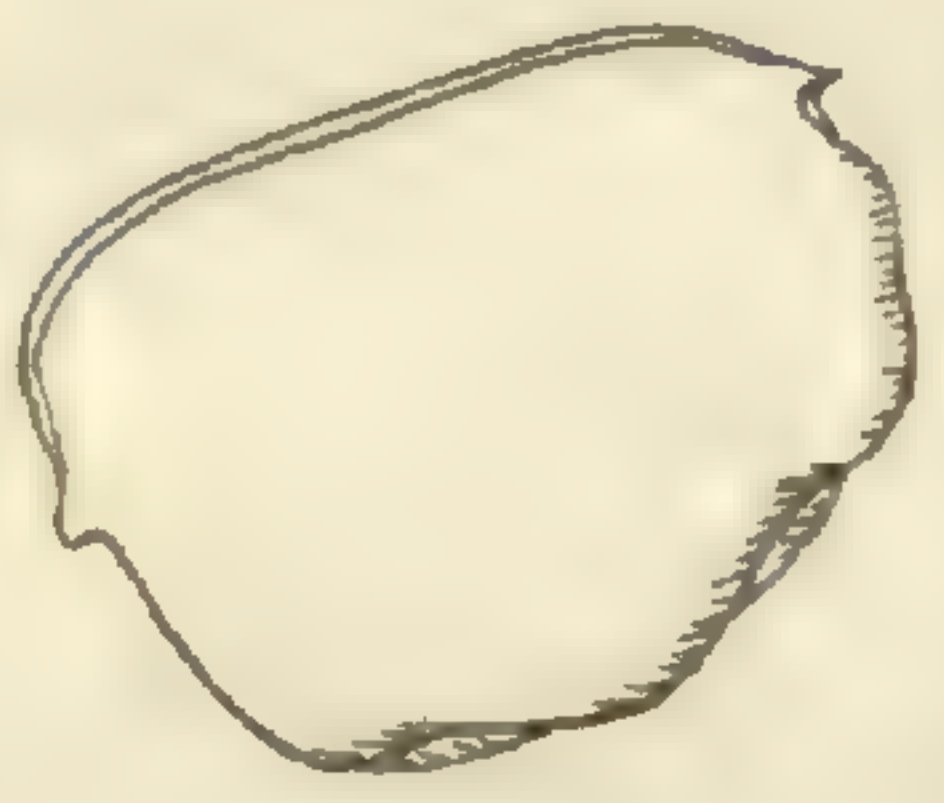
194 anisus



195 orthanthus



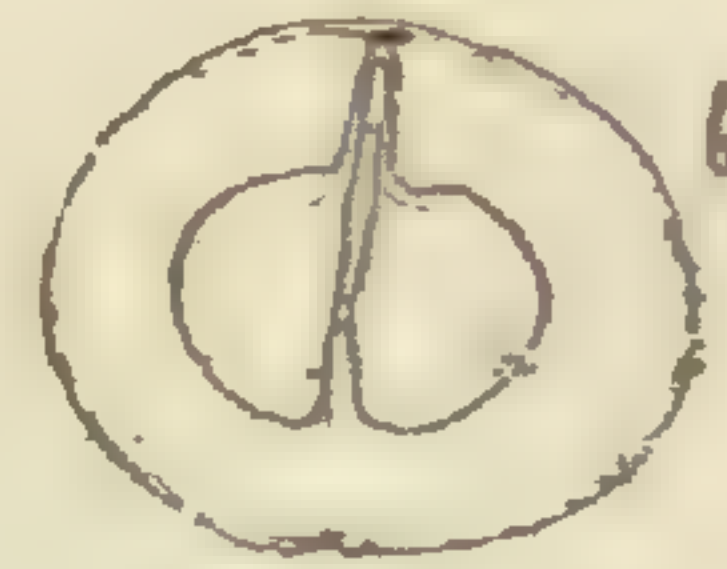
195 orthanthus



196 crabeisopus

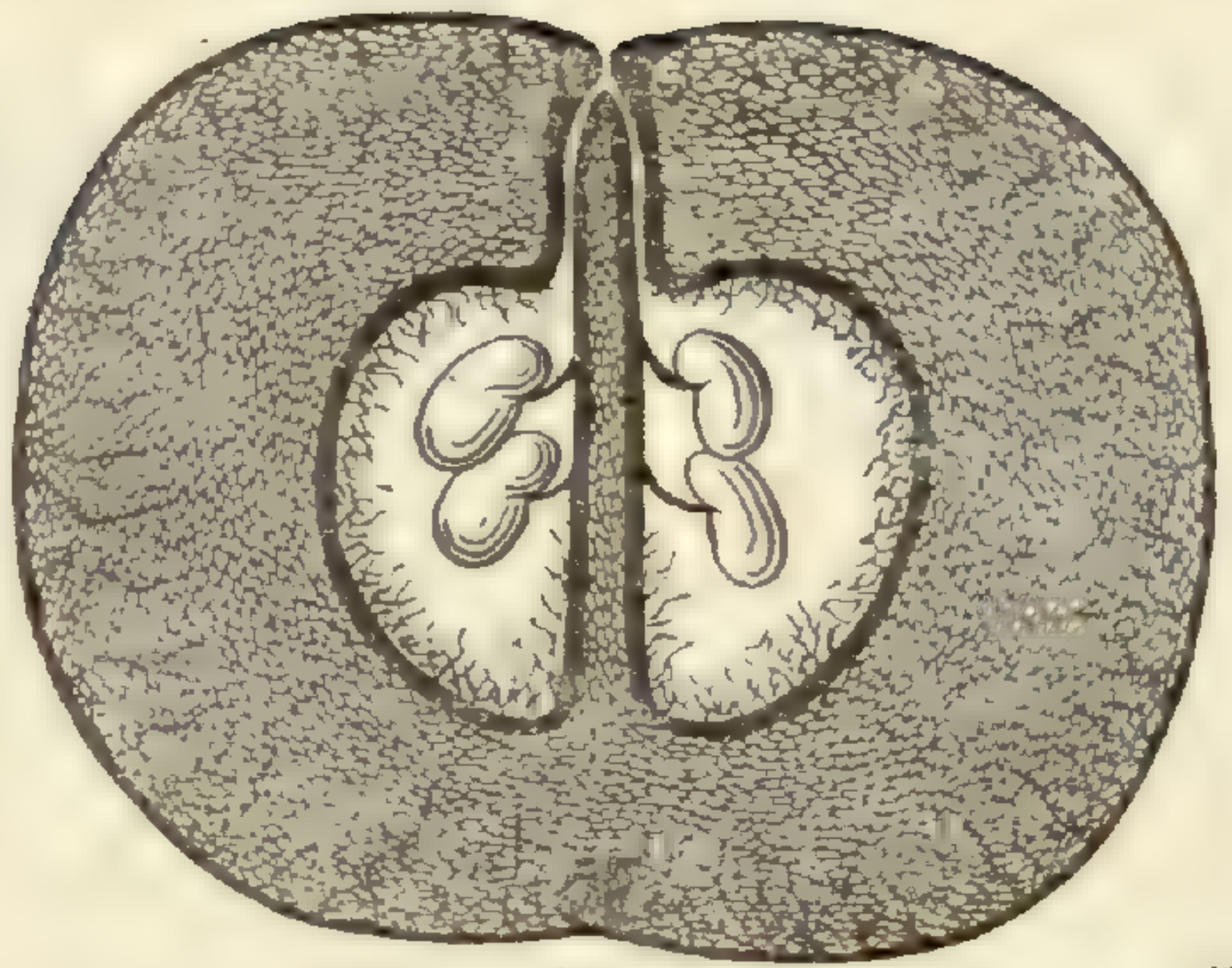


Handwritten text below sketch 'a'.



div x 2

(61)

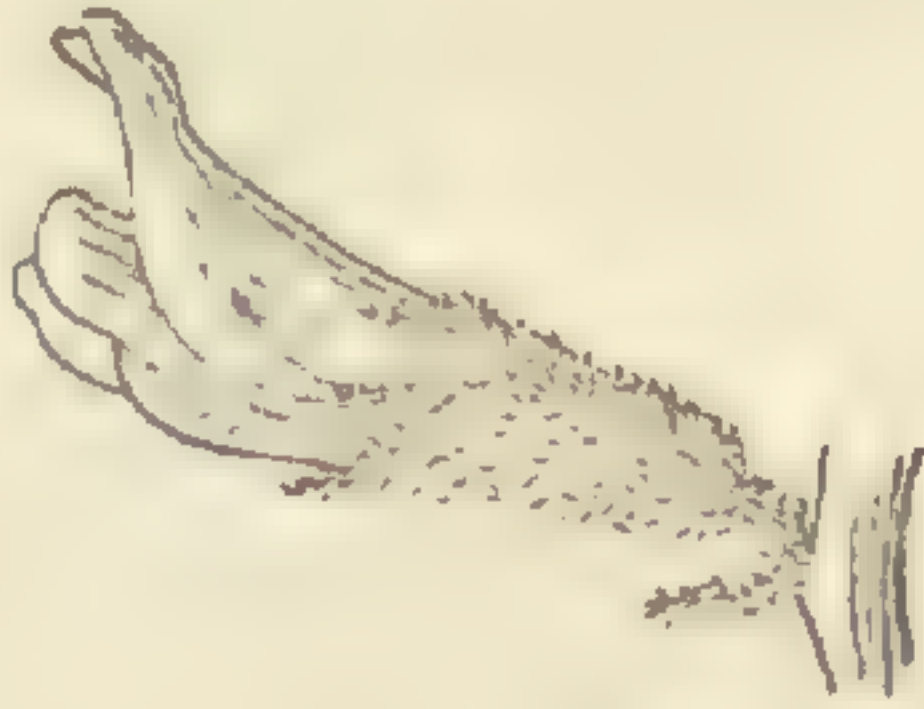


fresh x 2



fresh

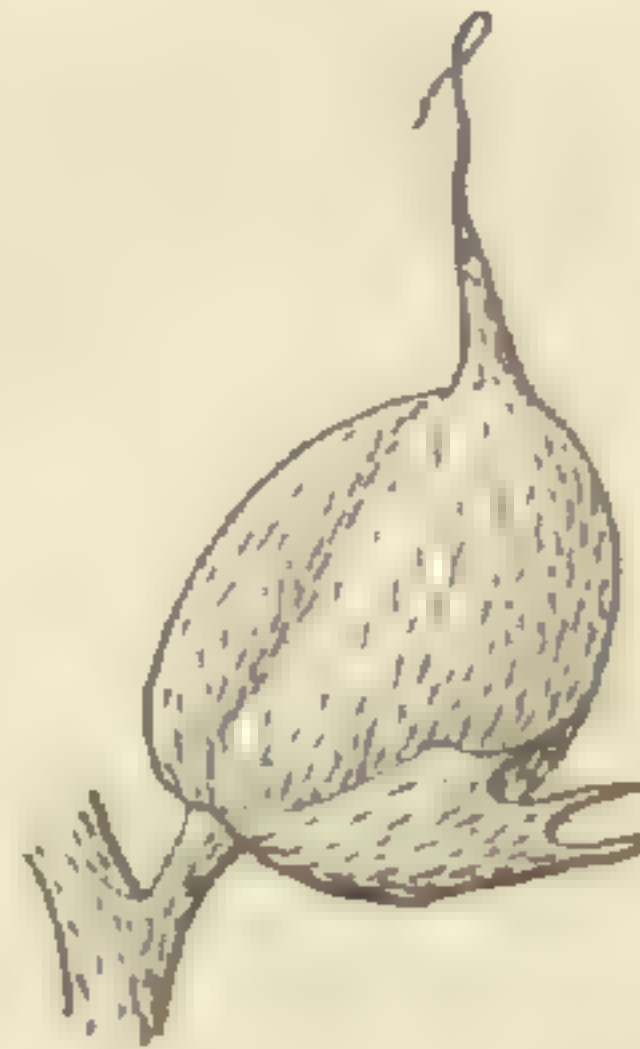
196 crassilobus
Var. pachycarpus



dry x 2



197 Mexicanus



dry x 2

198 Platensis

(62)



198 Flathead



leaf x 2



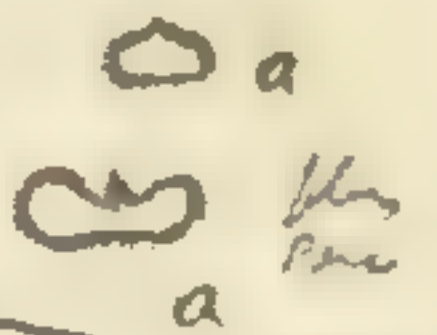
200 asperoides



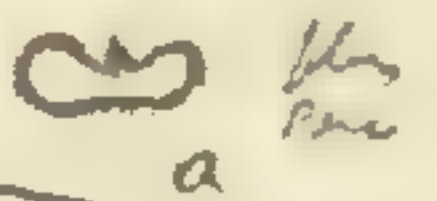
Var. faviiflorus



x 2



a



a

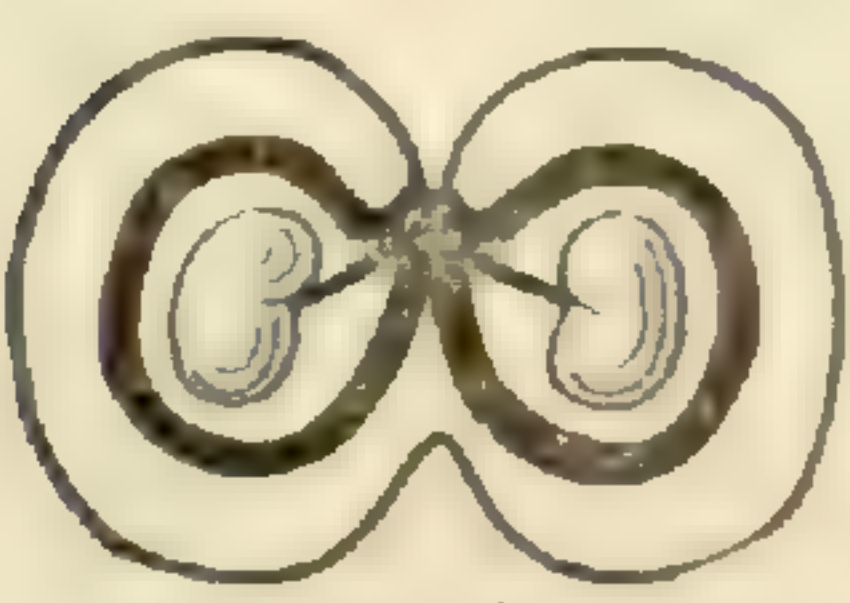


199 Tenuoscapula

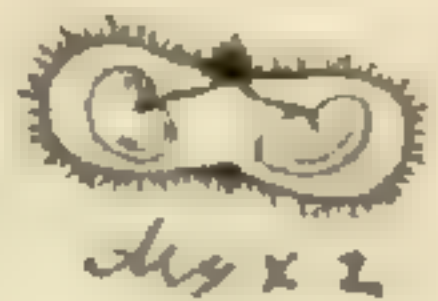


diag x 2

201 tenuiflorus



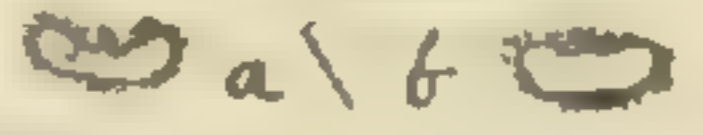
x 2



diag x 2



202 argillus



a/b



b



204 rugulodytes



205 Haydenianus

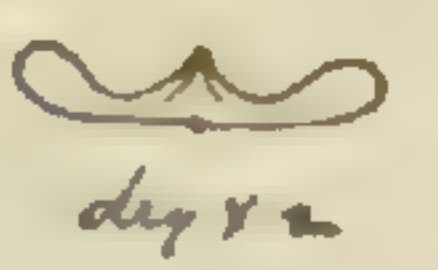


diag x 2

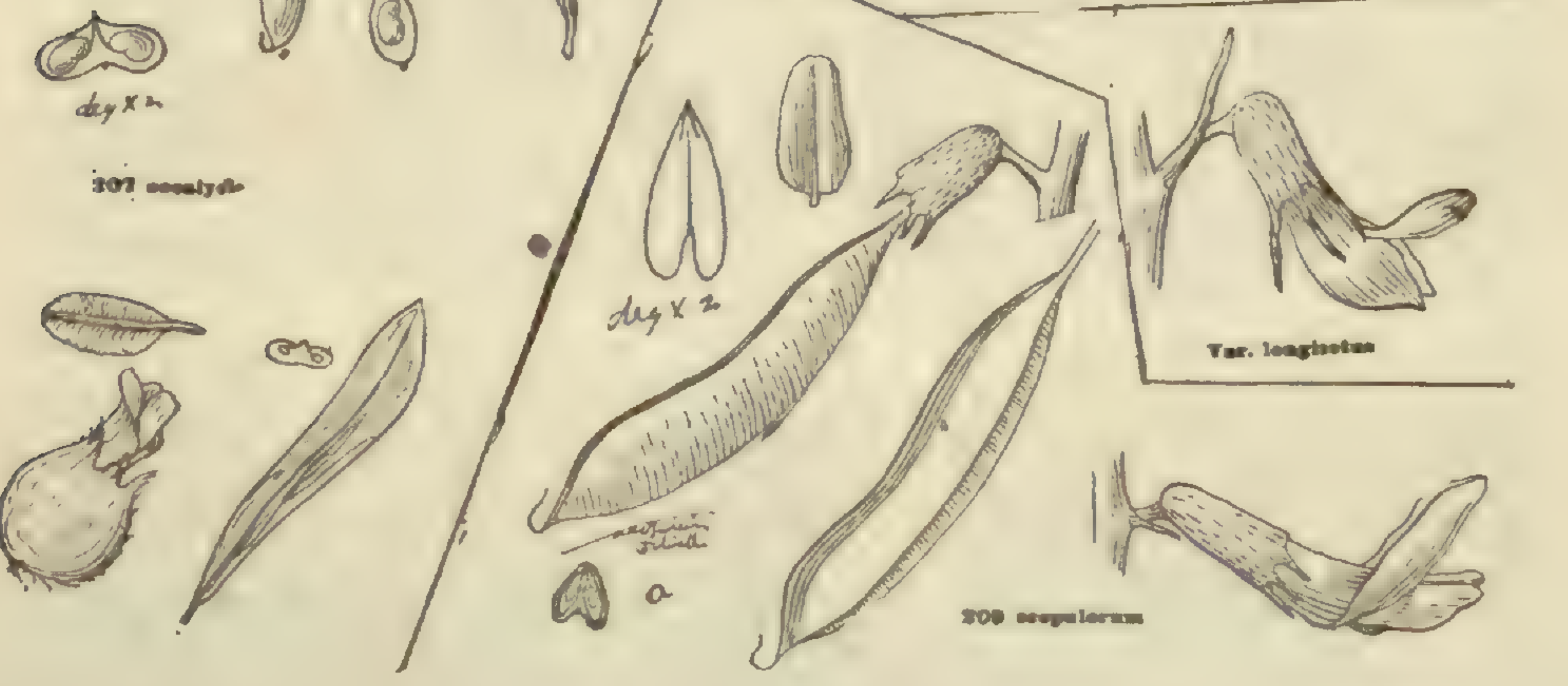
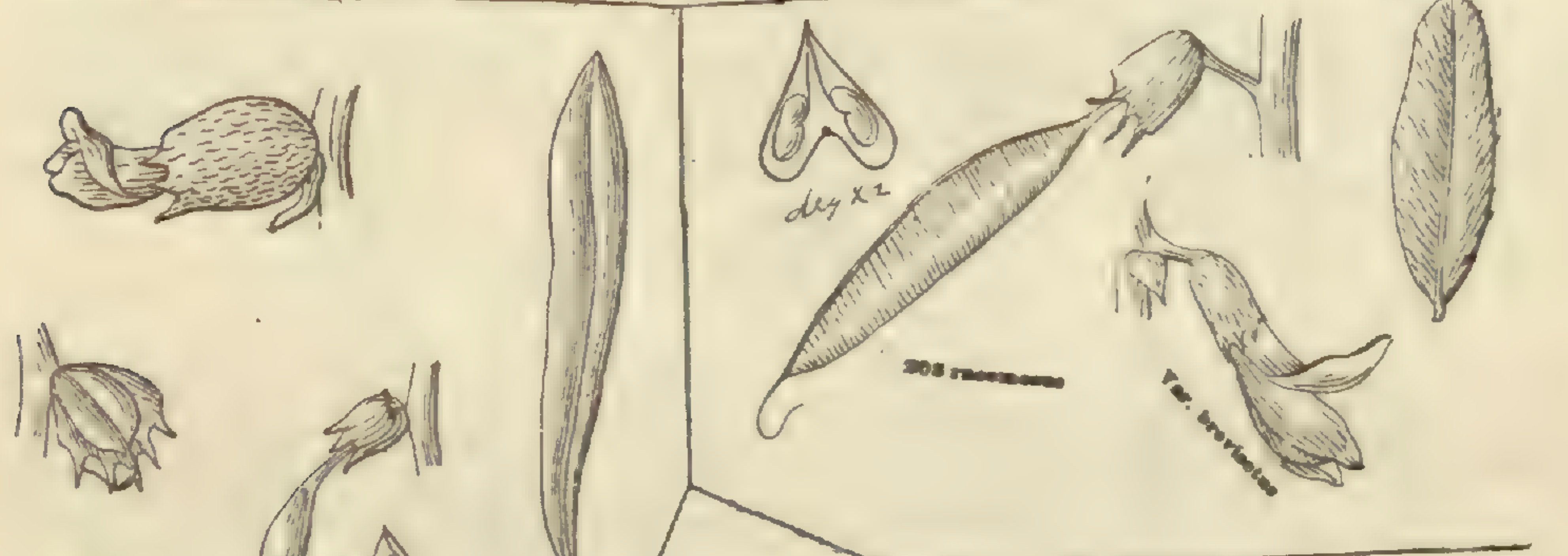
203 Moonocypus



diag x 2



diag x 2





diag x 2

Hamada



a

210 *Hamada*



Try x 2

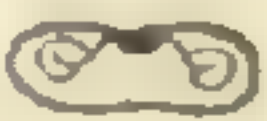
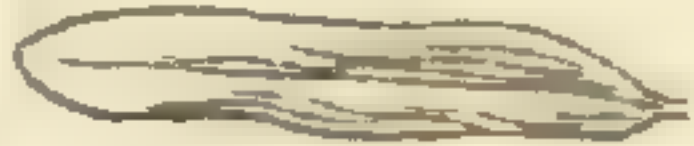
211 *Kaibensia*



212 *Osterhouti*



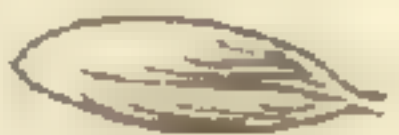
213 *Duchesneensis*



Hamada



a



215 *distorta*



214 *leucocarpus*



a



b

Hamada



c



d





Var. Engelmanni

216 glaber

217 Cochitilla

218 Arizonae

219 calycosum

220 Bernardinus

Var. scaposum

221 tricarlinatus

223 Gronthopu

dry x 2

dry x 2

dry x 2

dry x 2

dry x 2

dry x 2

dry x 2

dry x 2

dry x 2



A. Orcuttianus var. Gregorianus



166



223 drepanolobus

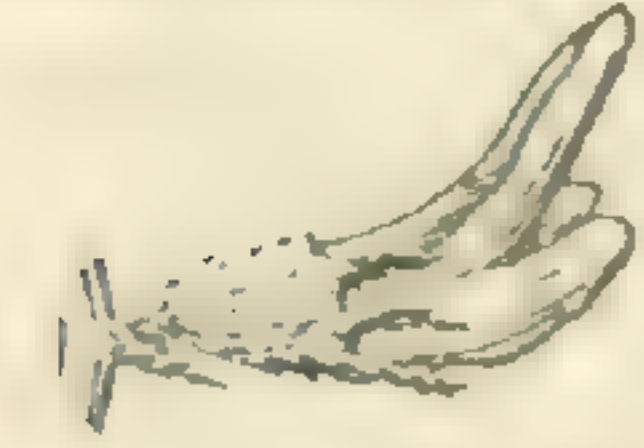


diag x 2



diag x 2

224 Congdoni



a'

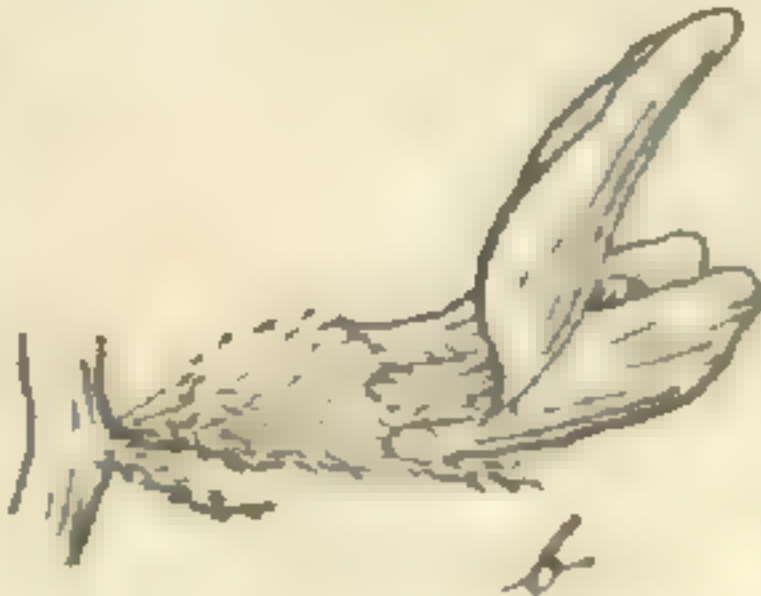


diag x 2



Andersoni

a



b



b

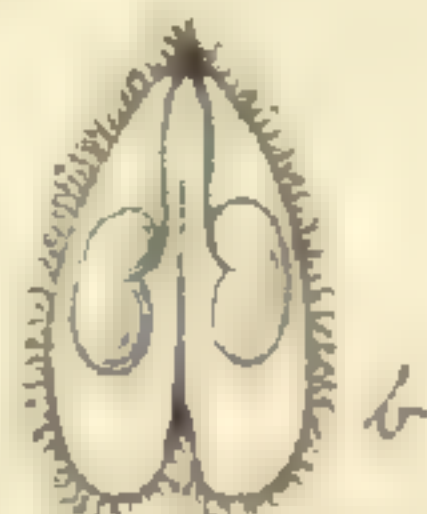
225 Andersoni



Andersoni

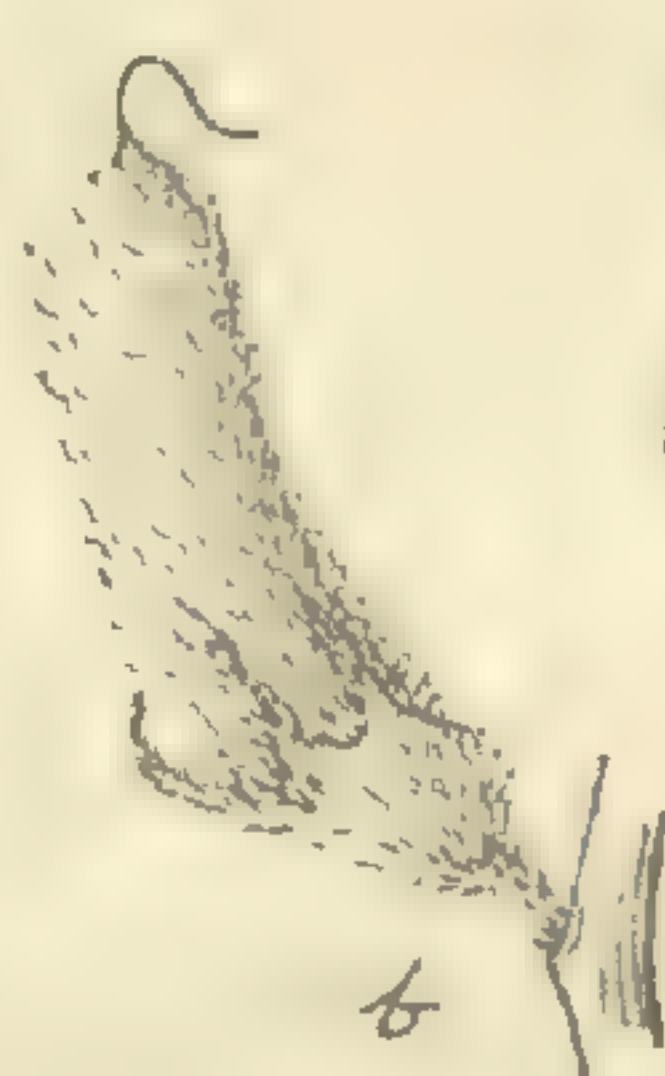
a

a

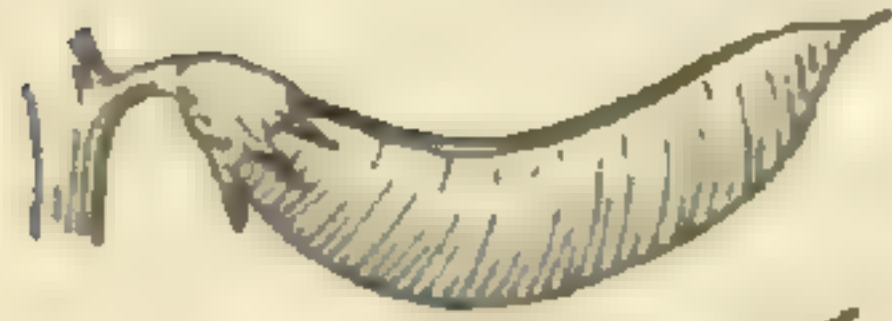


diag x 2

b



b



226 sylvaticus



diag x 2



227 albus



diag x 2

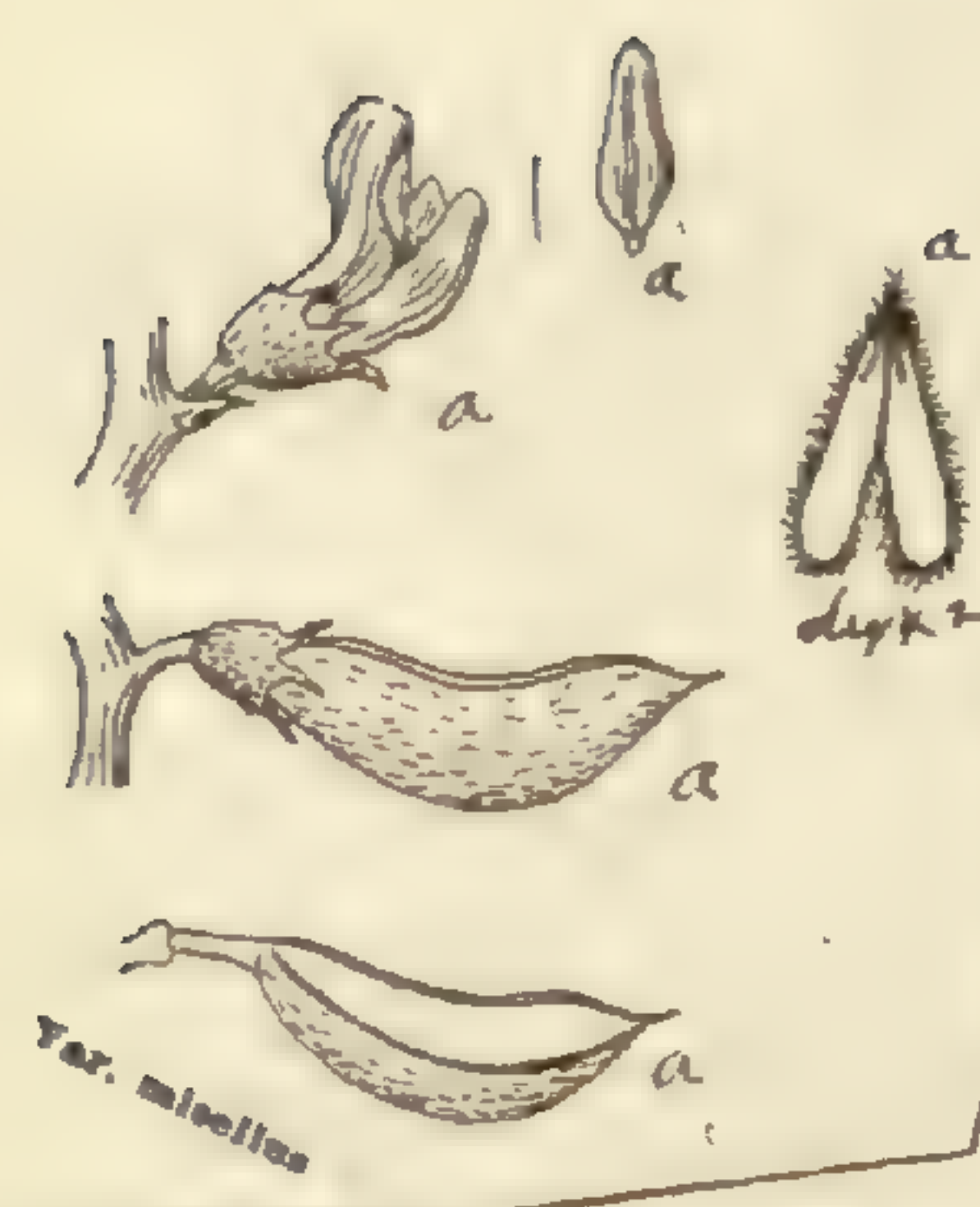


228 Howellii



Var. micellus





Yar. micellus



229 Mulfordii



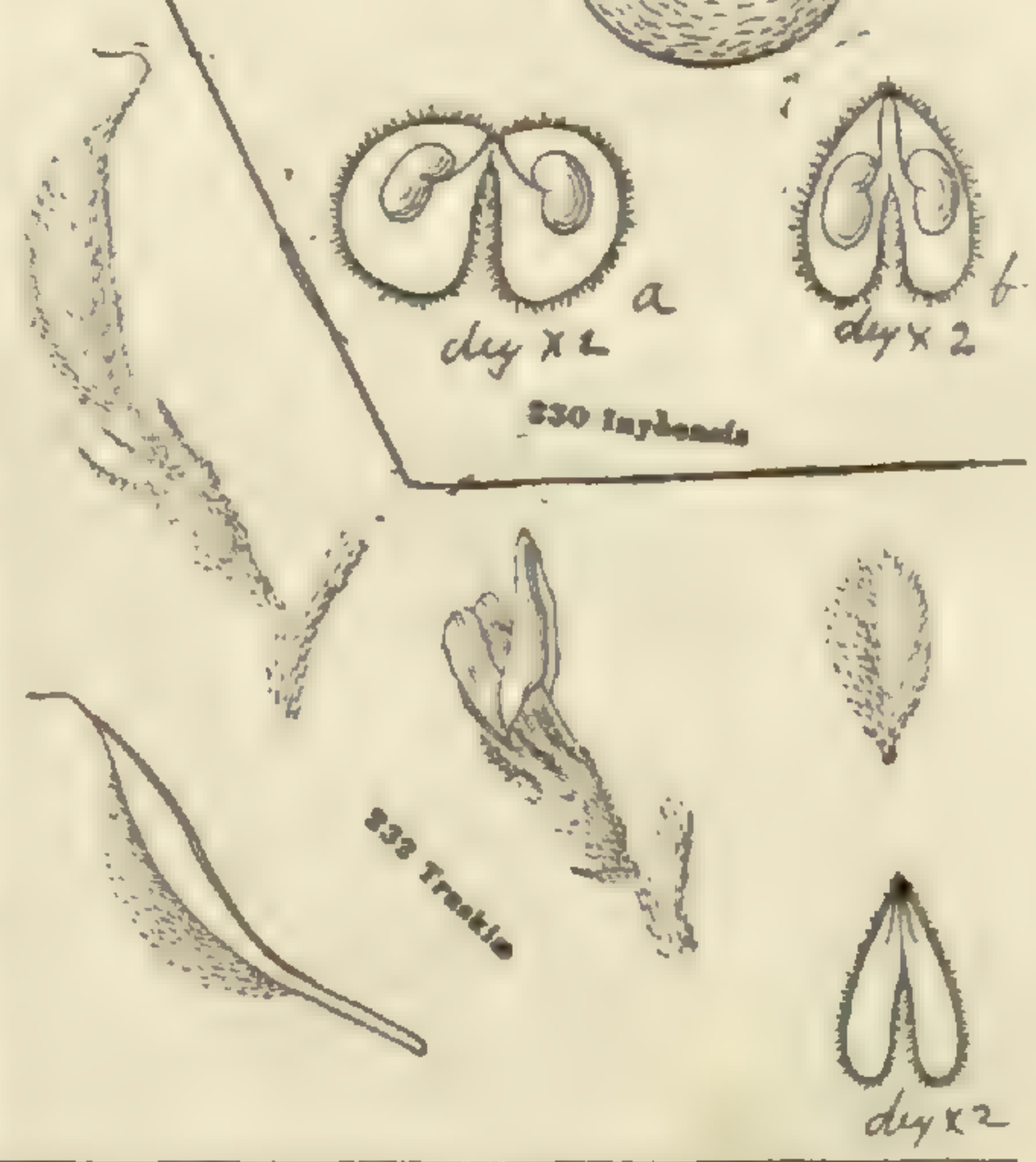
230 Inybonis



231 Nevilli



232 Trankie



233 Arthurii



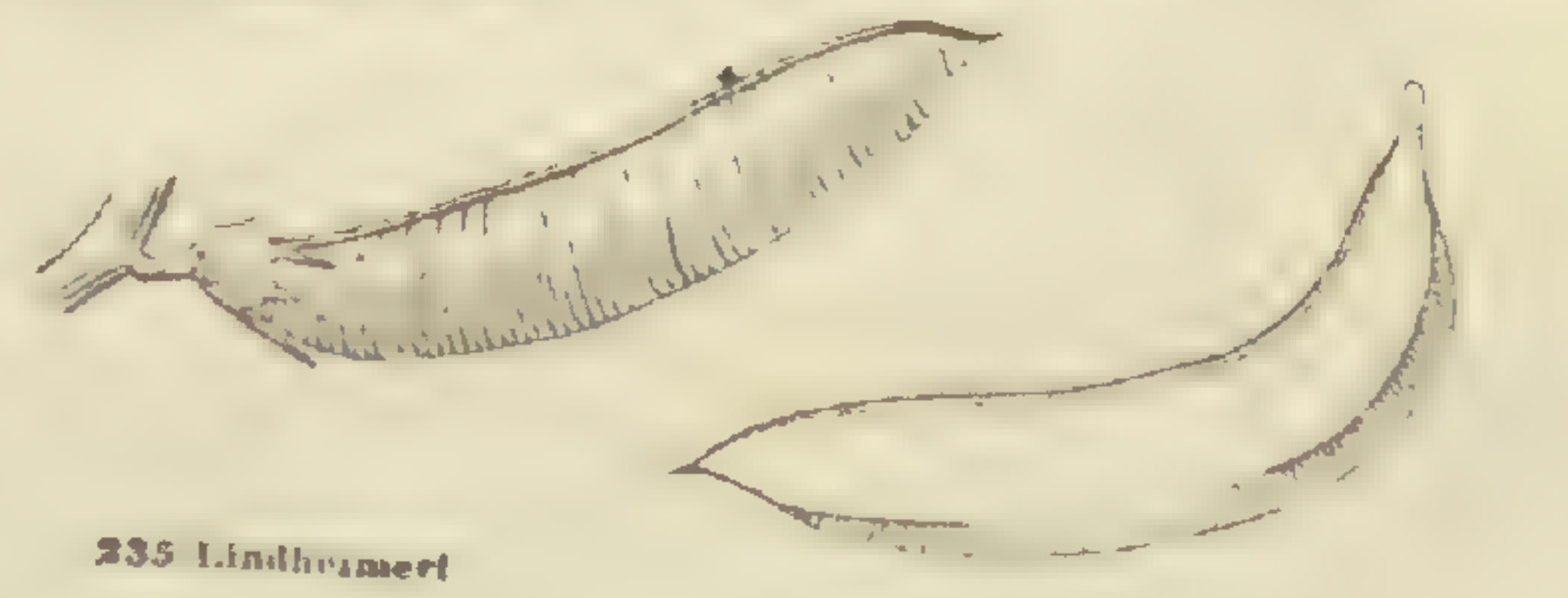
234 Franciscuttensis



A. Franciscuttensis var. Lagunensis



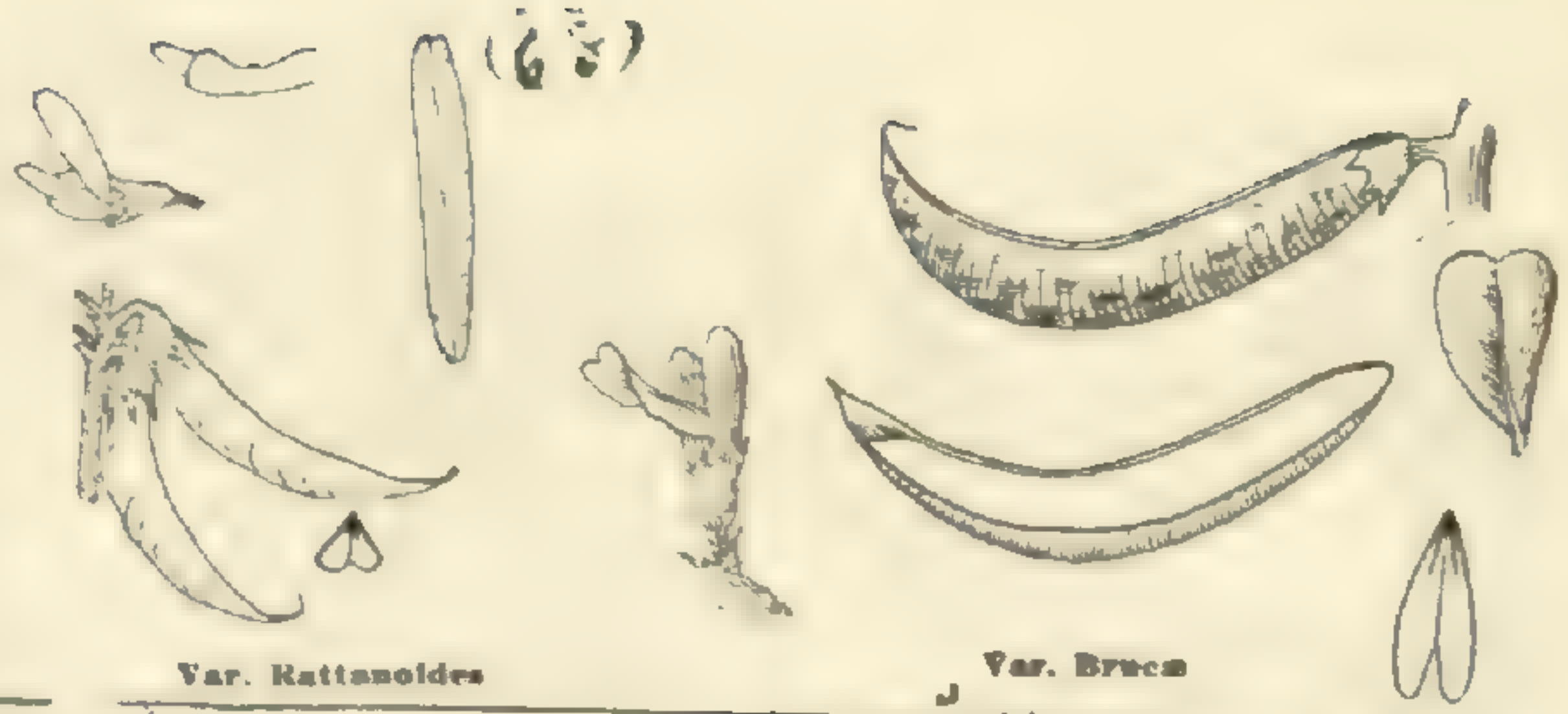
235 Lindheimeri





236 leptocarpus

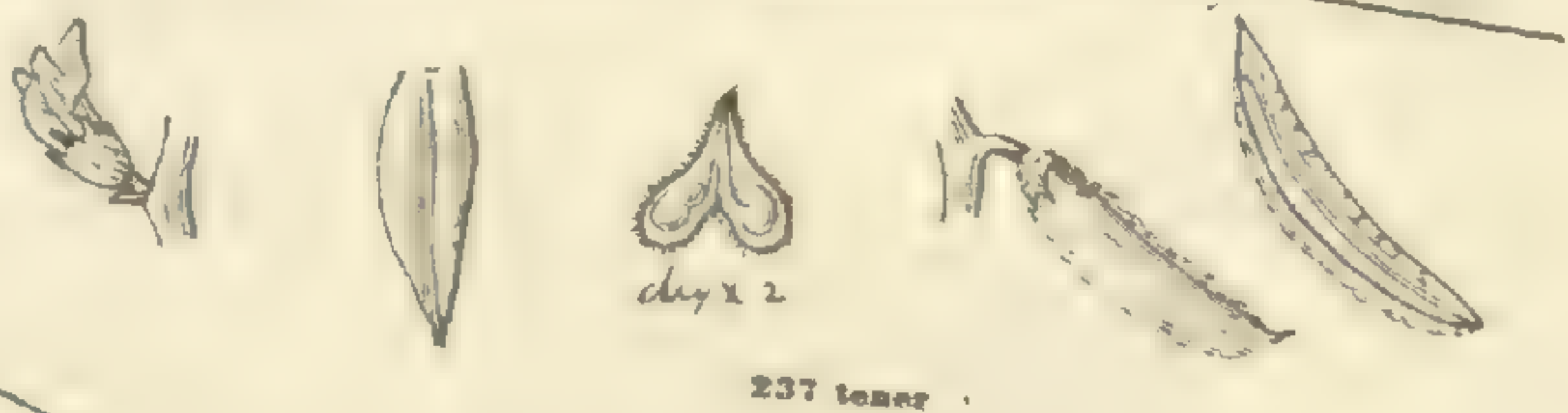
diag x 2



Var. Rattanoides

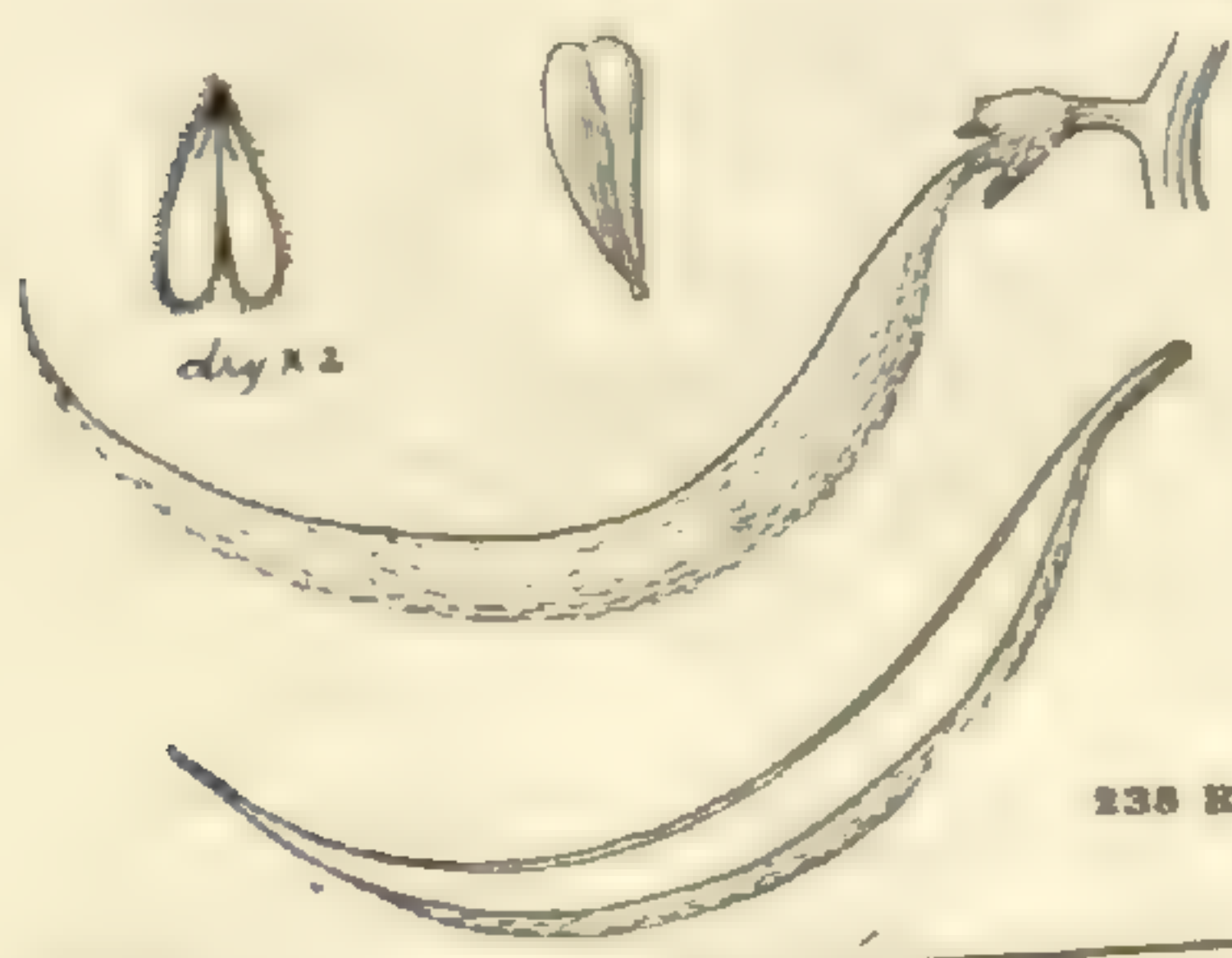
Var. Brucei

diag x 2



diag x 2

237 tener



diag x 2

238 Rattani



diag x 2

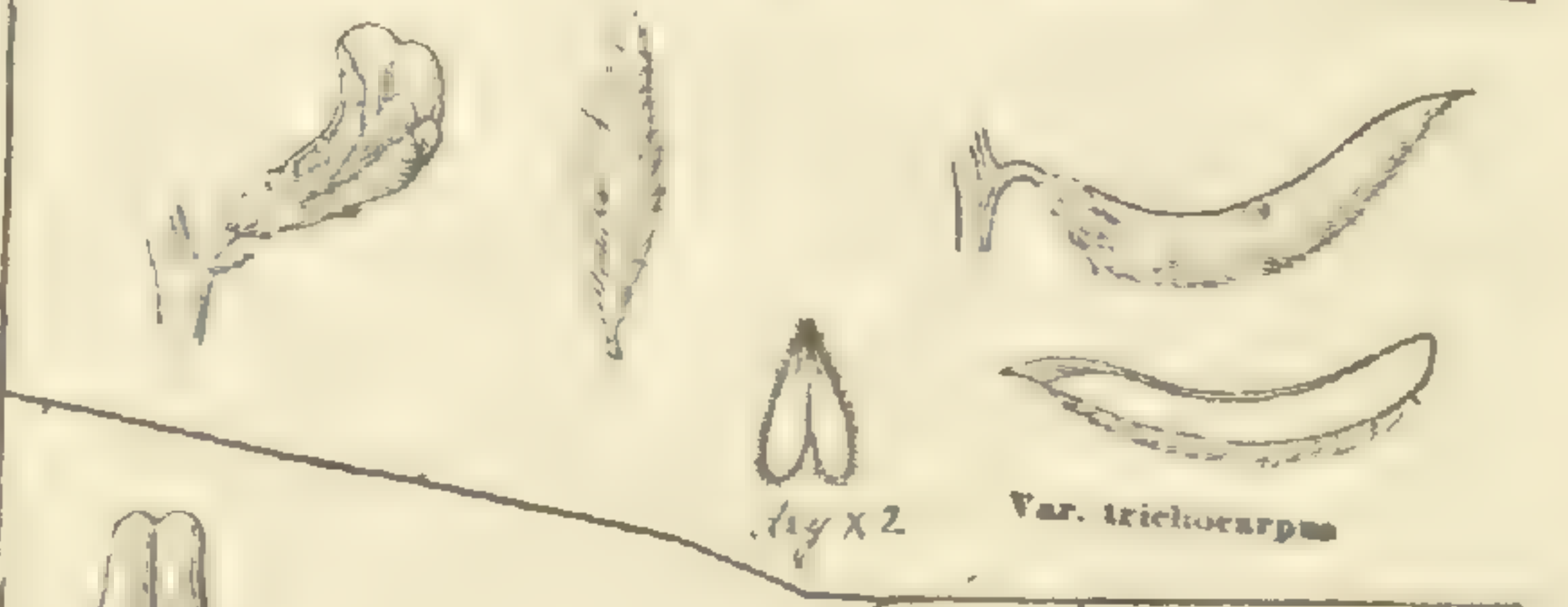
239 Wrightii



diag x 2

240 Nuttallianus

a a
b b
b b



diag x 2

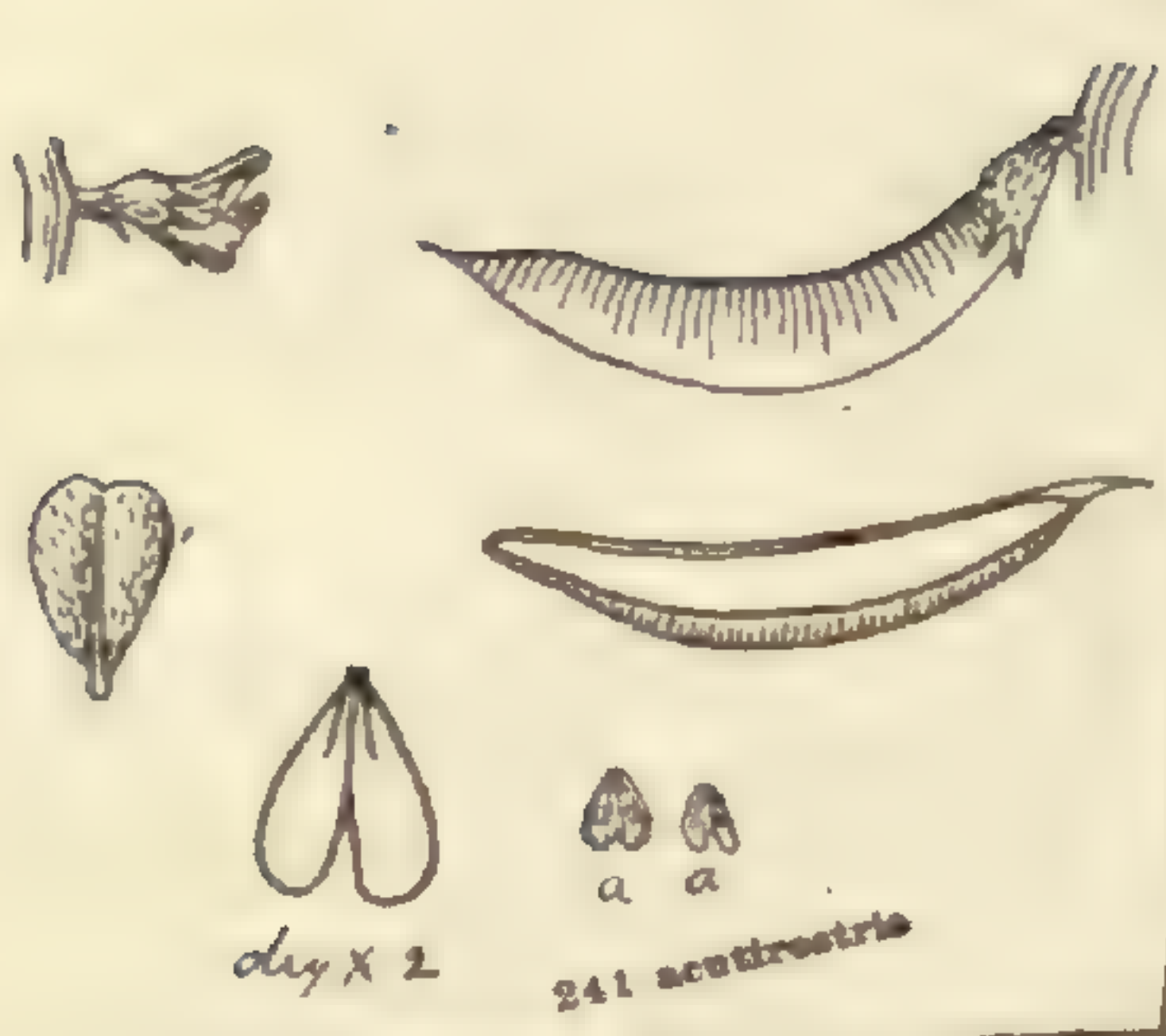
Var. trichocarpus



Var. quadrilateralis



Var. Cedroensis



241 acutirostris



242 rothorys



243 len...



244 Madrensis



246 Groggii



249 Pringlei



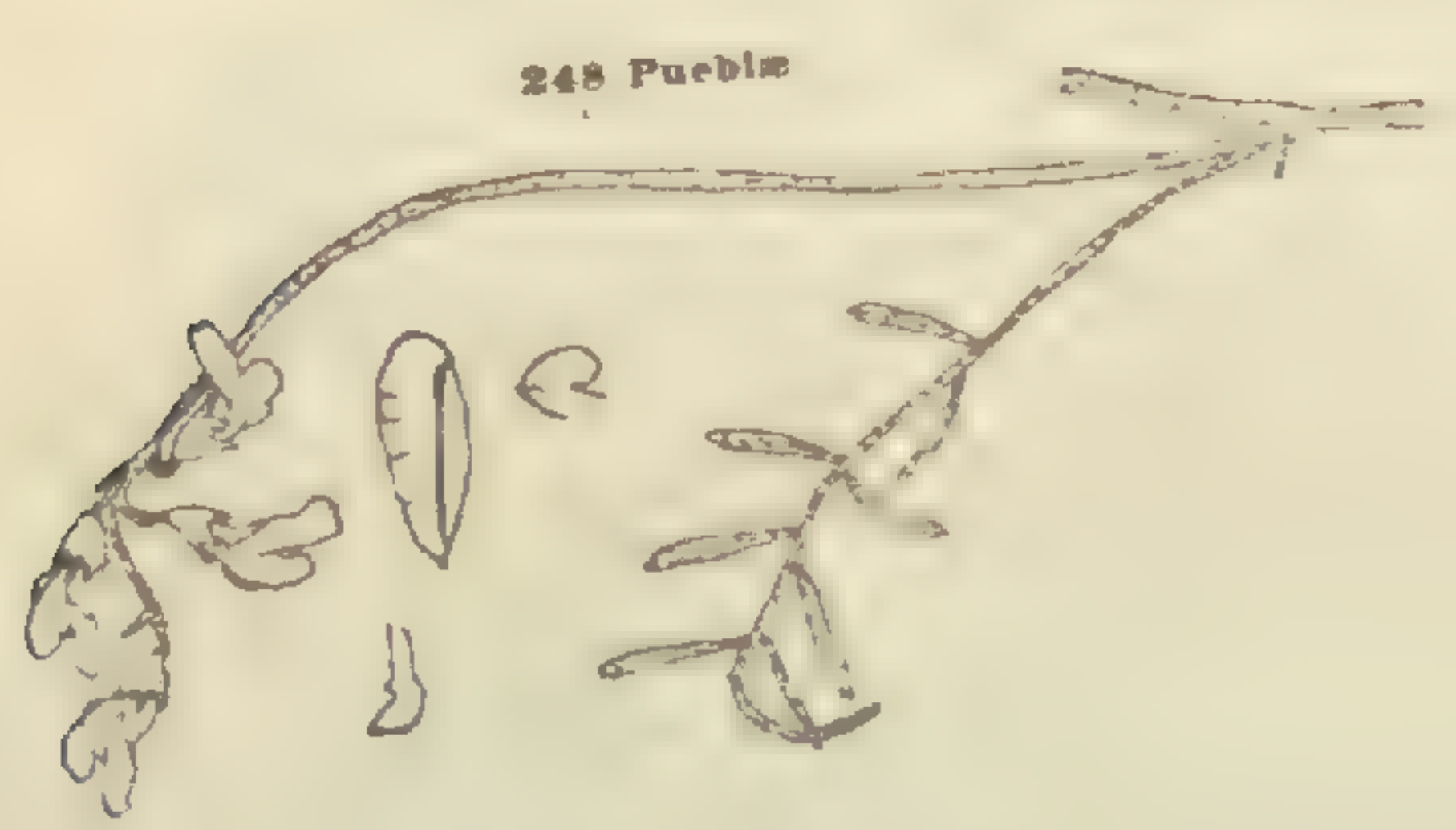
252 Lemmonii



247 Lulstannae



250 parvus



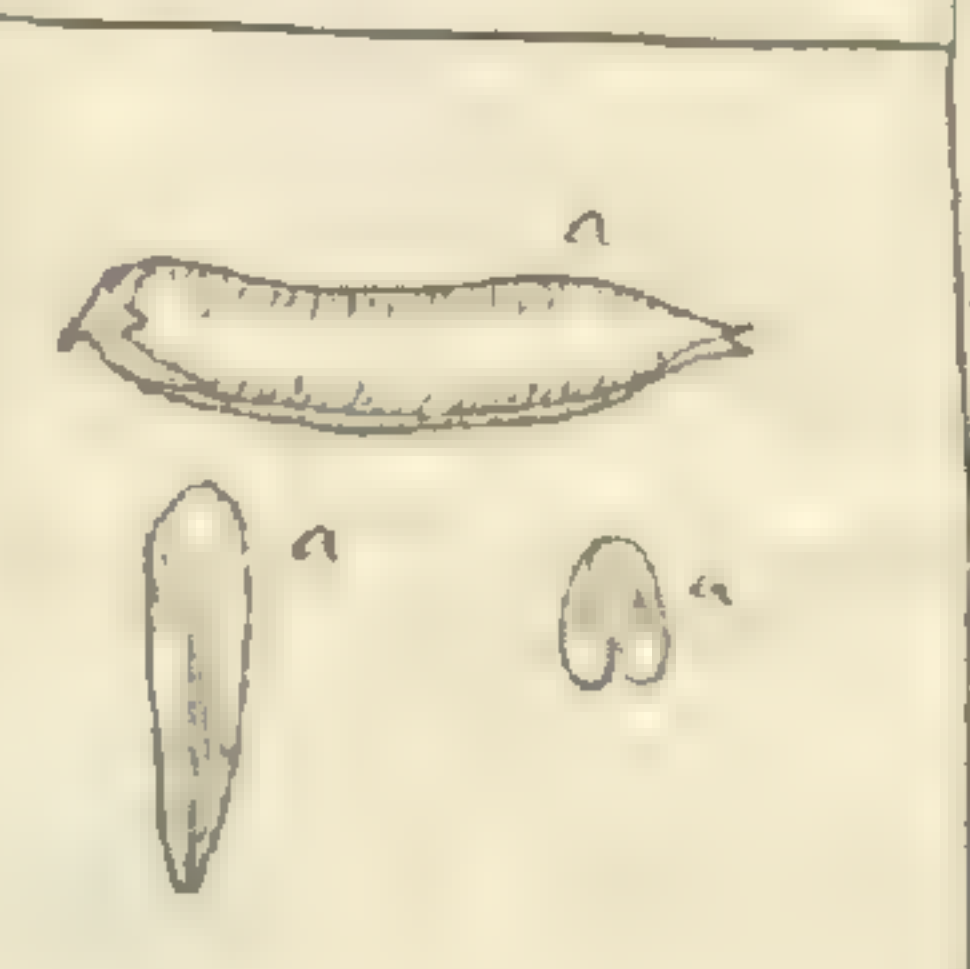
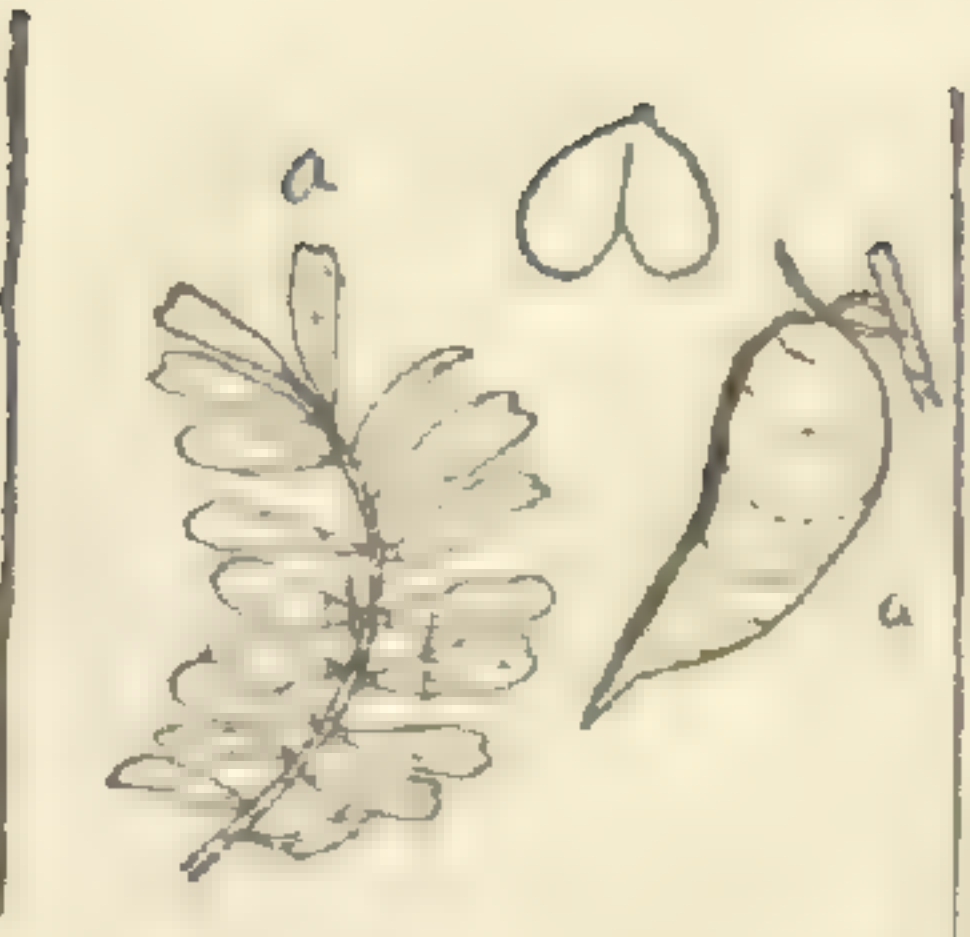
248 Pueblae



251 Schaffneri



251 Schaffneri



253 Esperanzae



clay x 2



254 Chapalaensis



255 hypoxylon

clay x 2



256 Hartwegi

clay x 2



259 vaccaria

clay x 2



257 militaris



258 battonia



260 hypoleuca

clay x 2



261 oxytrichoides

clay x 2



263 Goldmani



262 battonia

clay x 2



264 Clevelandi

265 Purpurea

266 reflexa

dry x 2

dry x 2

dry x 2

267 nigrescens

268 Breweri

dry x 2

269 didymocarpus

dry x 3

270 diaperinus

dry x 2

dry x 2

271 diphaeus

dry x 2

A. diphaeus var. peonis

ultra

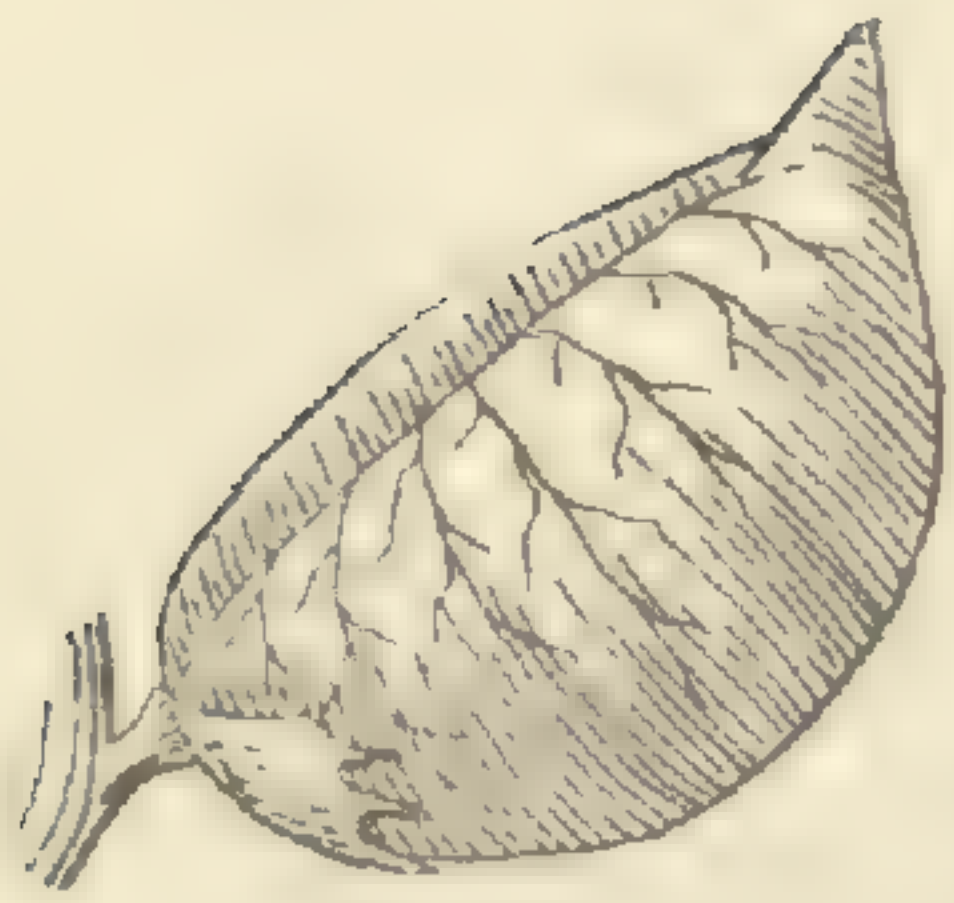
272 Angelicus

dry x 2

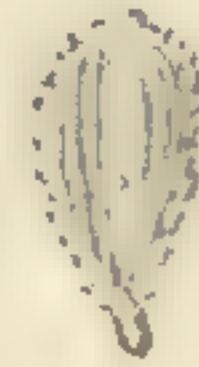
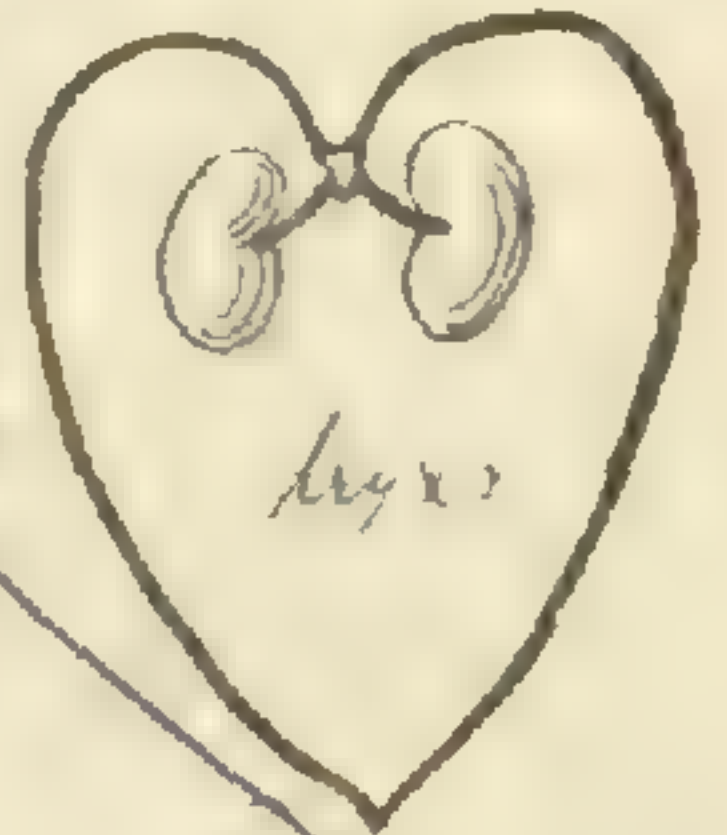
273 Brassicoides

A. Douglasii var. plicatus

(72)

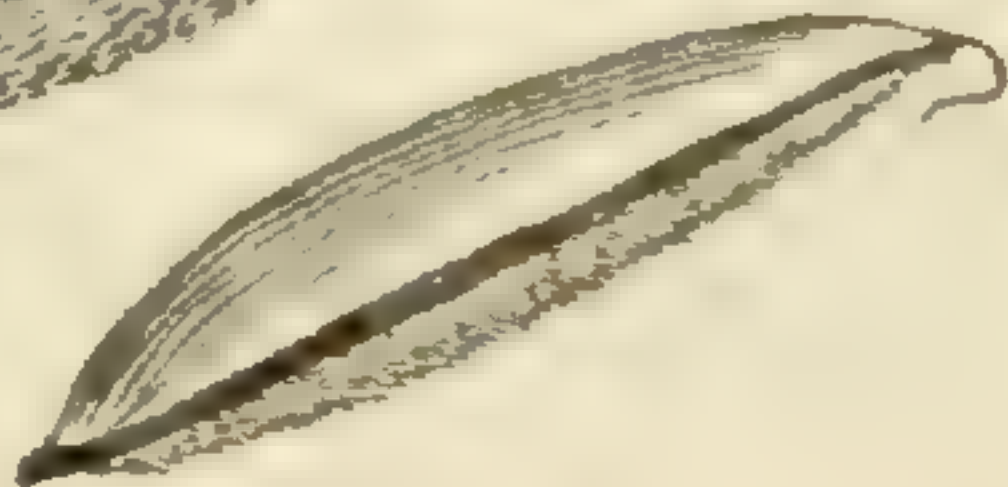
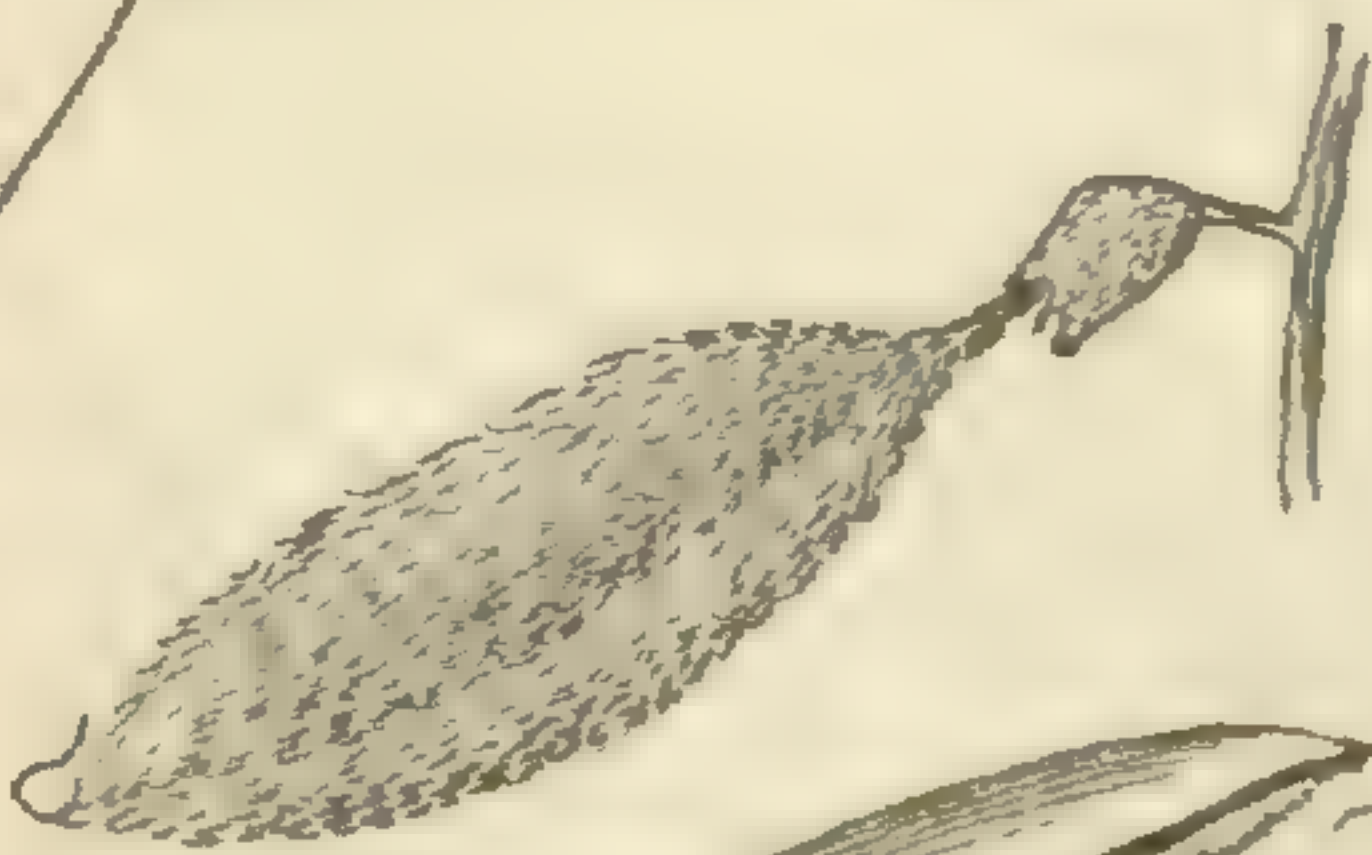


61 Wetherill



77 Beckwithii var. Weberensis

A. lentiginosus var. Idriensis



82 circumdatum



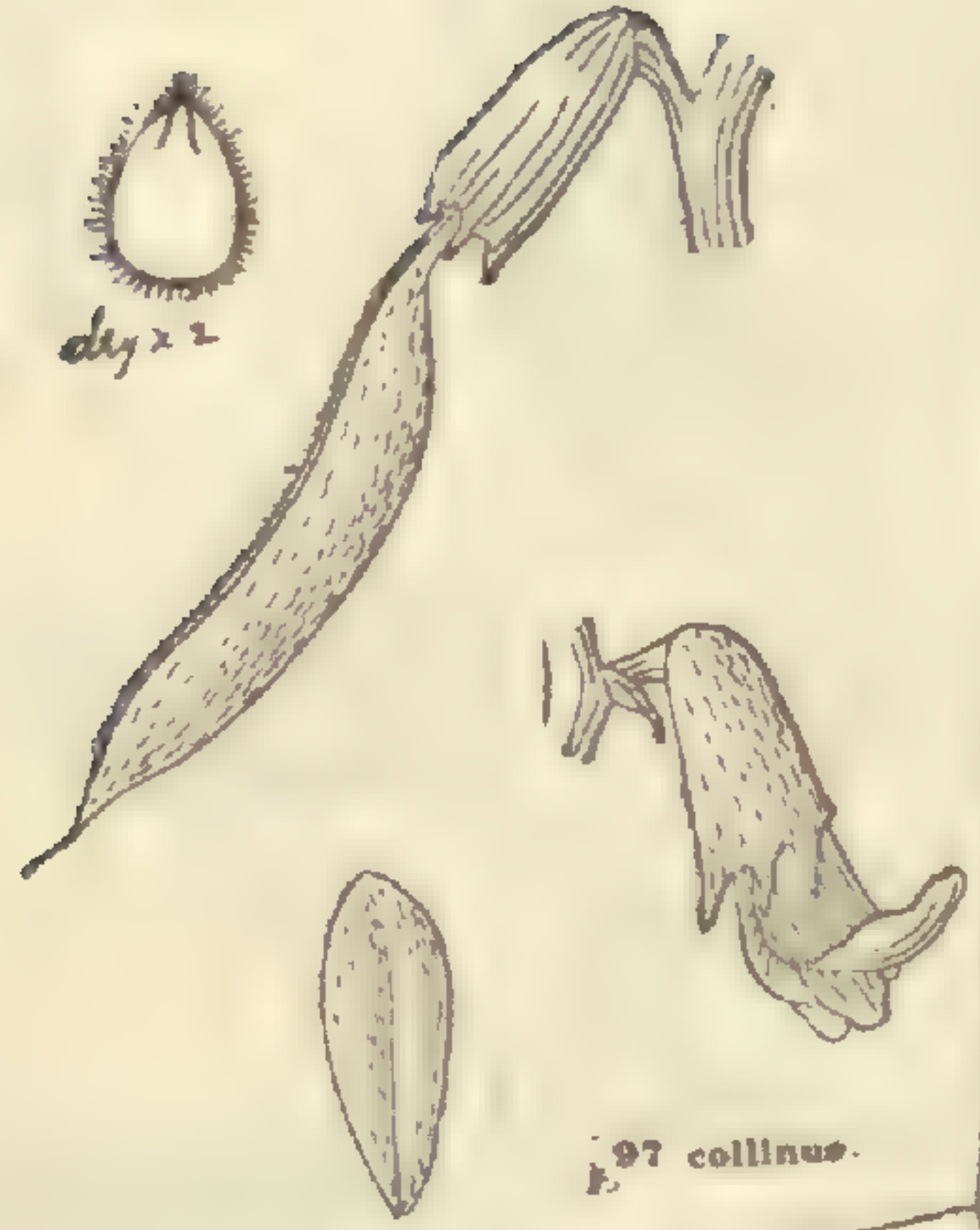
80 alpinum



83 Mohavensis



dry x 2



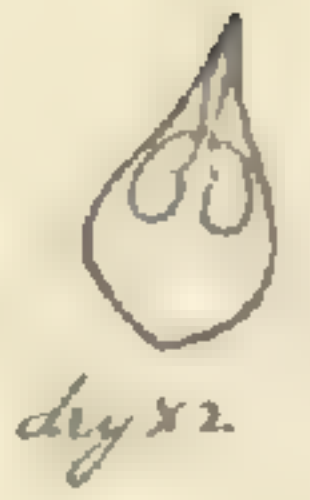
97 collinus.



dry x 2



96 Tweedyi



dry x 2



98 porrectus



dry x 2

101 Toanus



103 Casel



fresh x 2



dry x 2



dry x 2

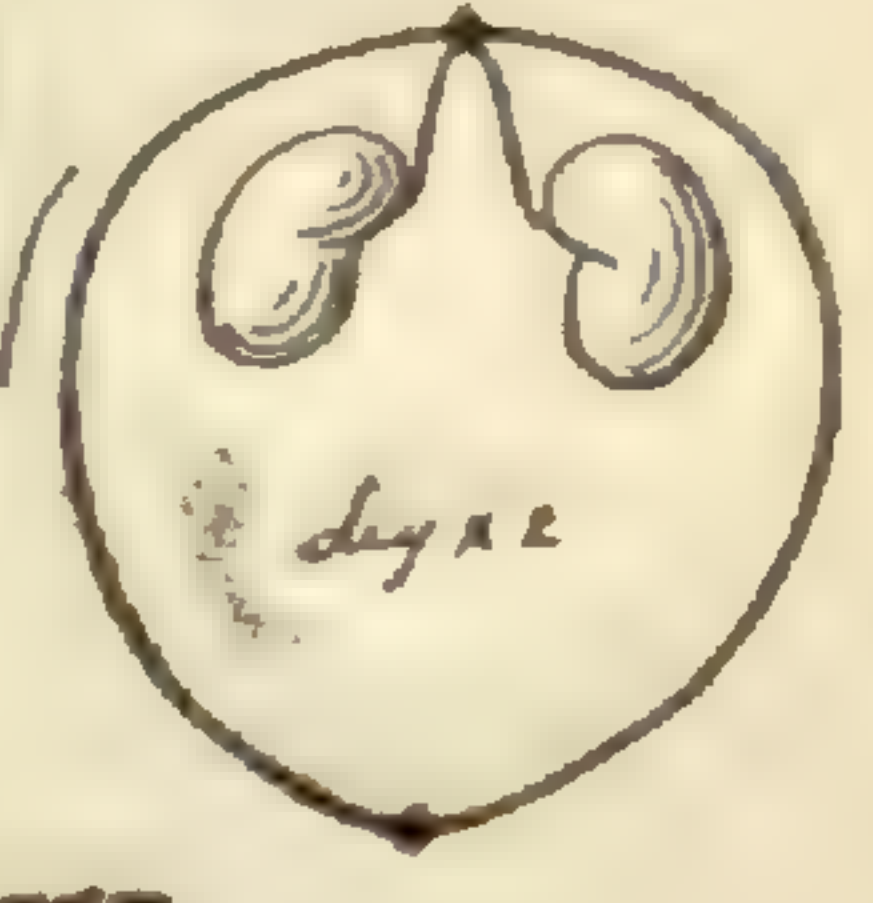
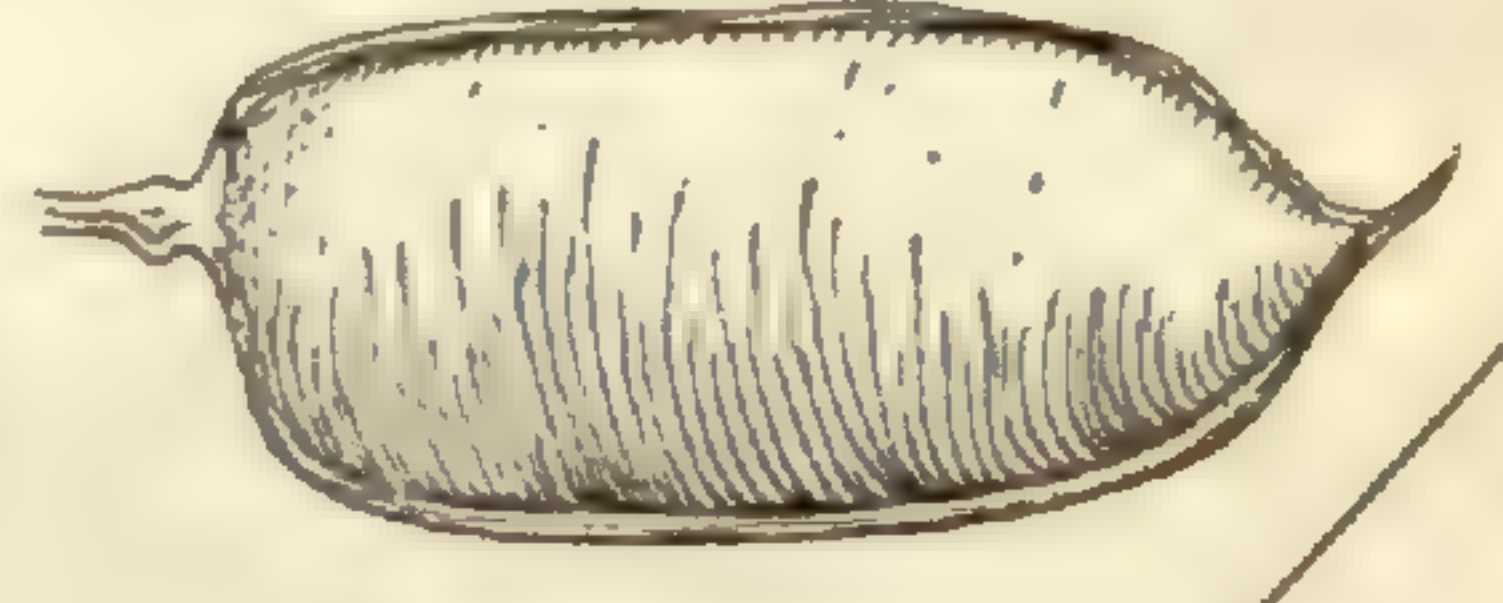
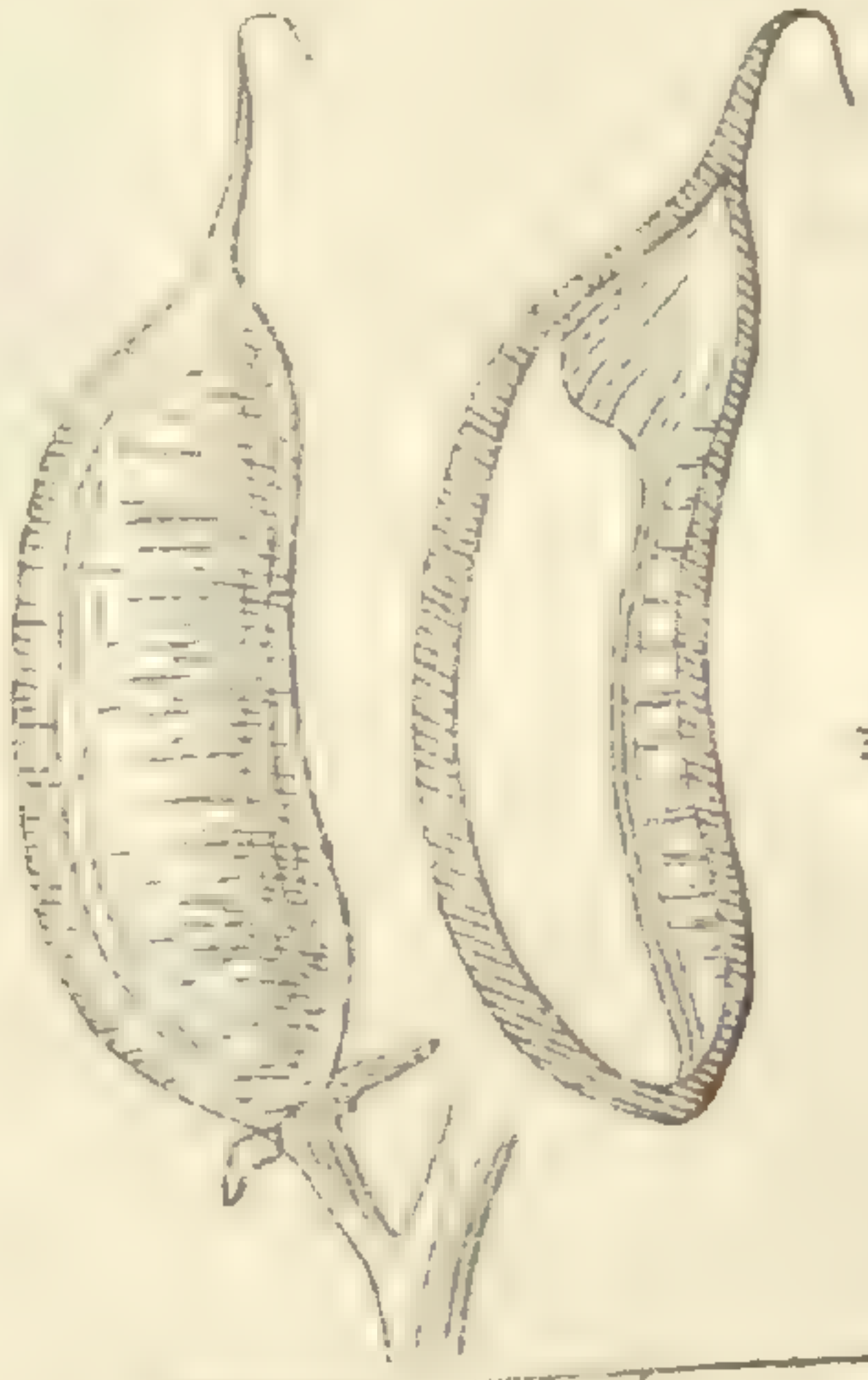
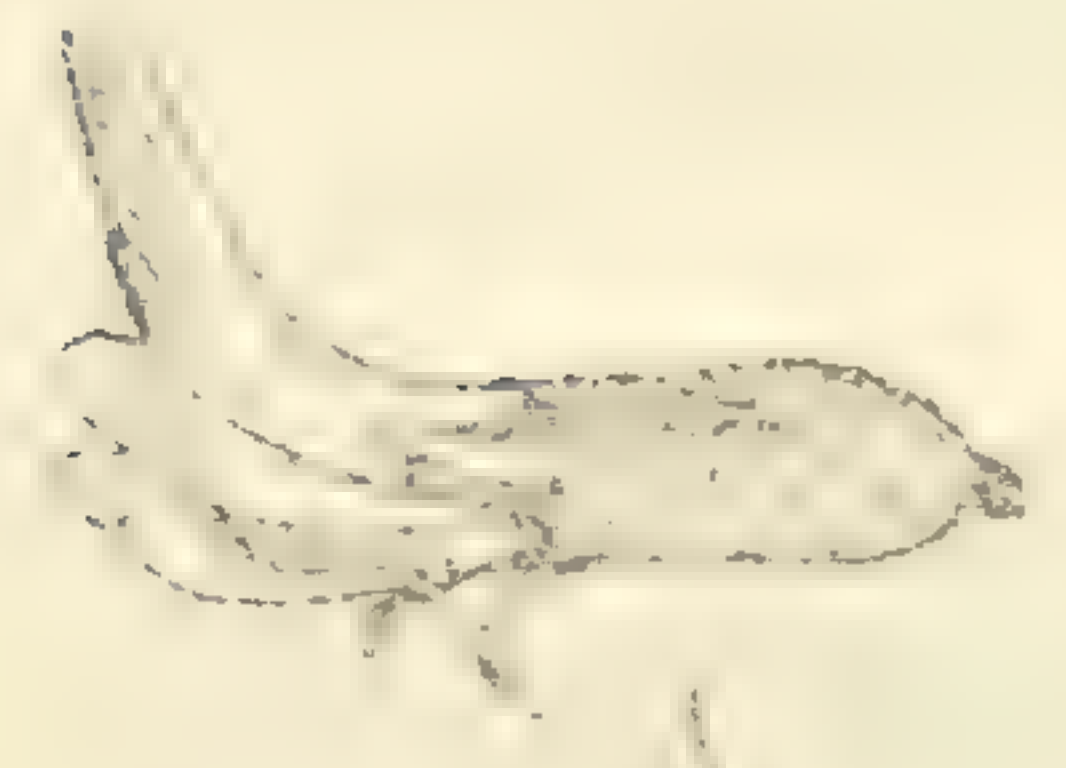
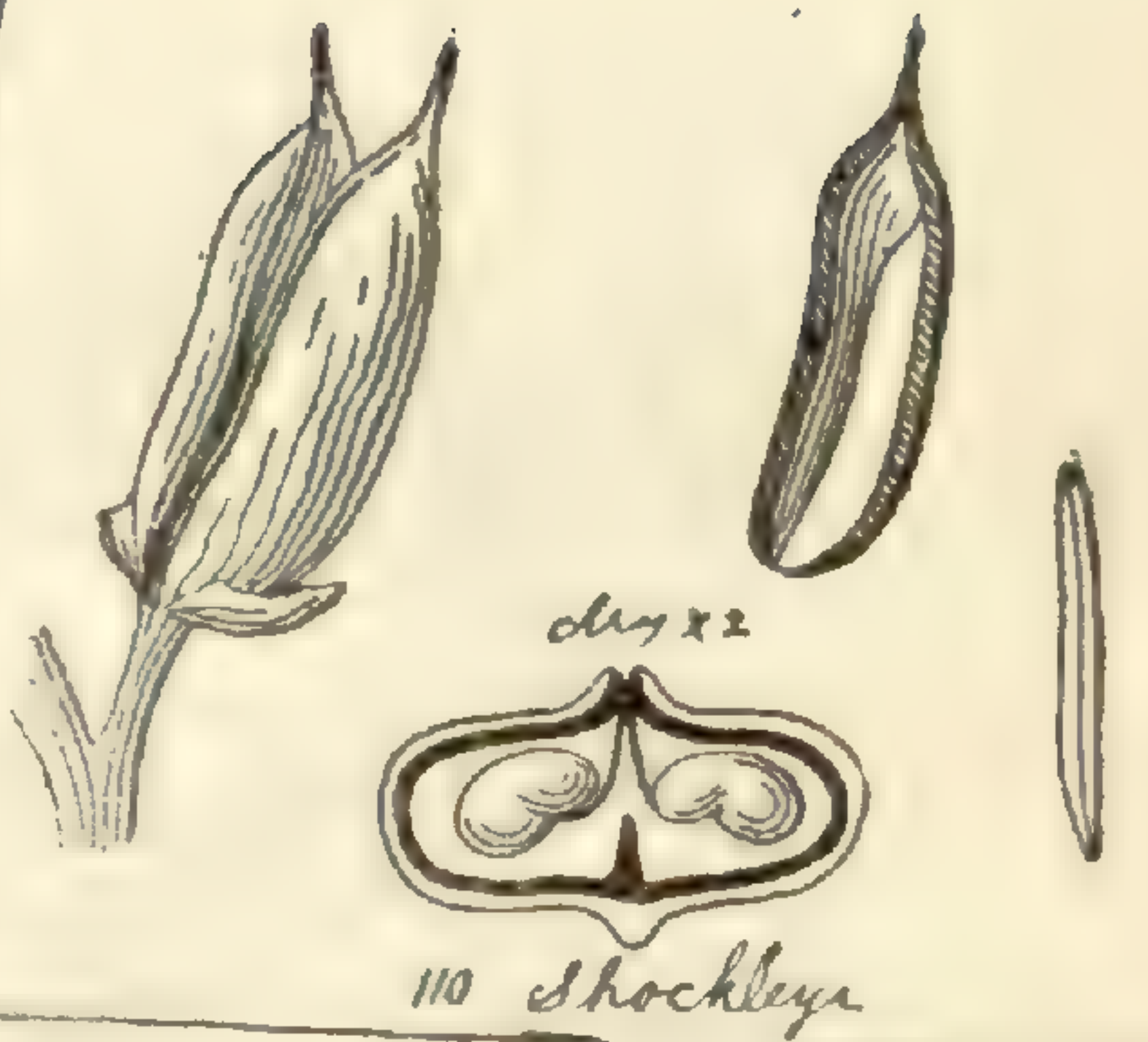
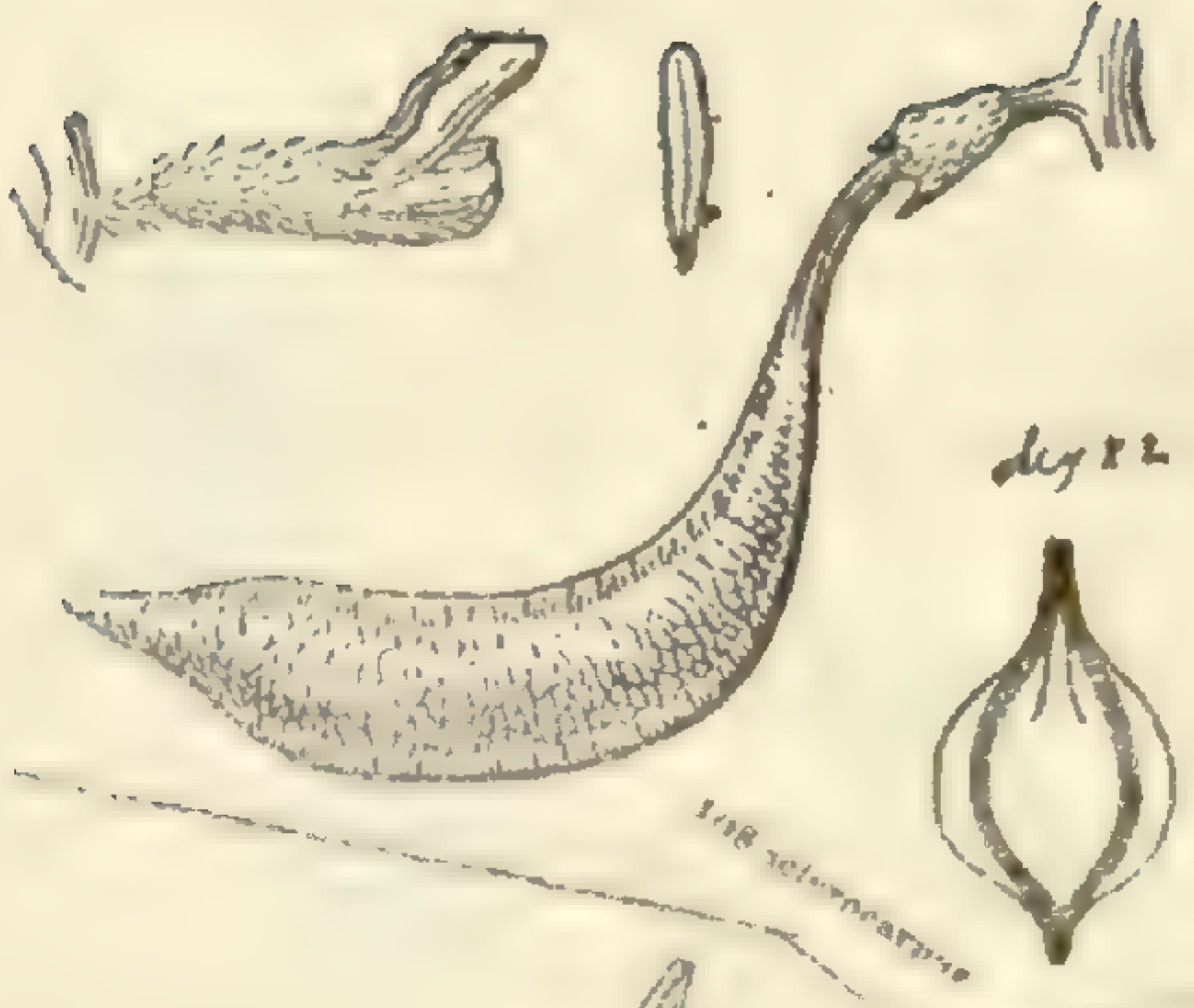
103 Grayi



106 pterocarpus



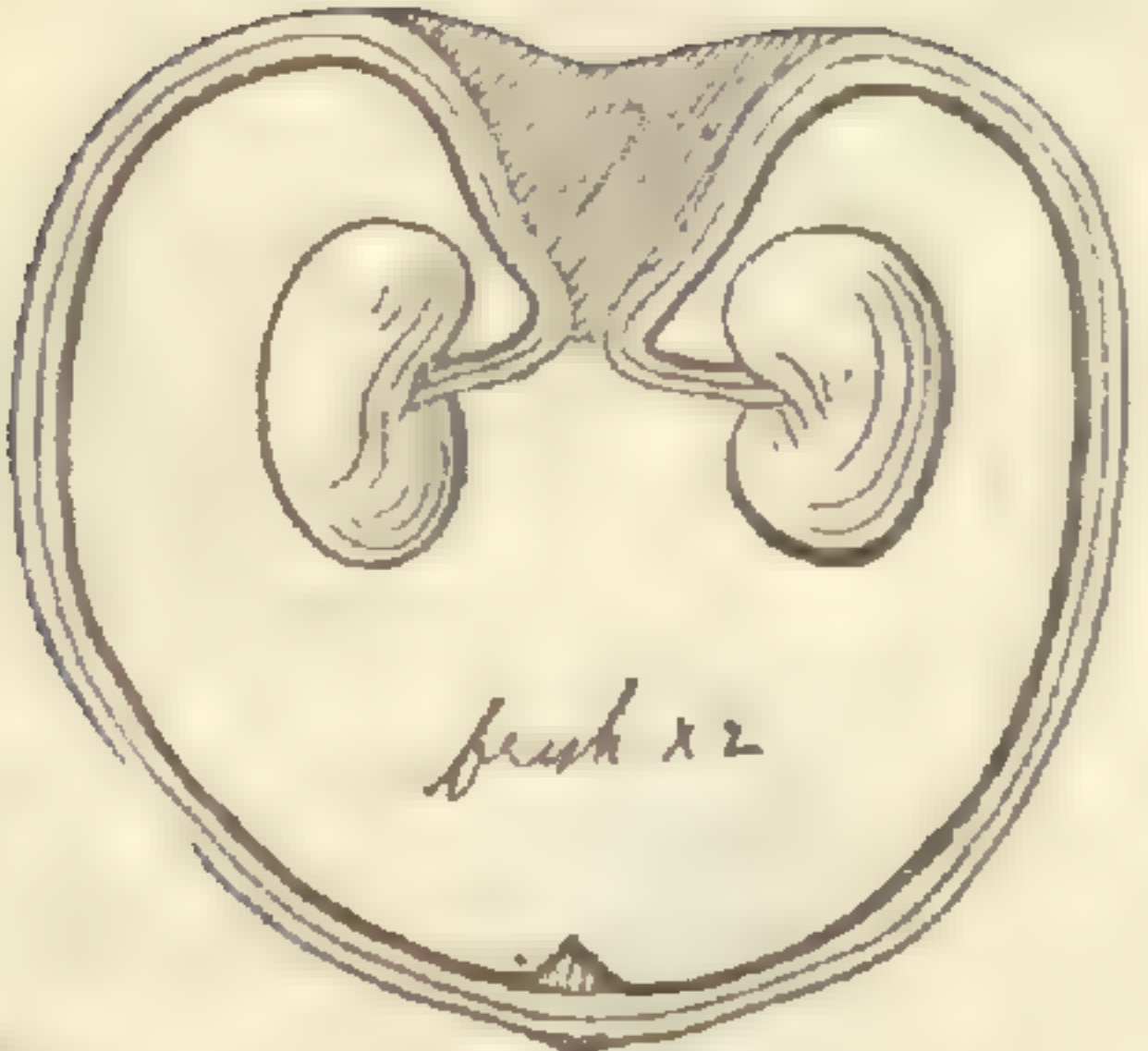
dry x 2



112 *Ferula* var. *laeviflora*.

113 *...*

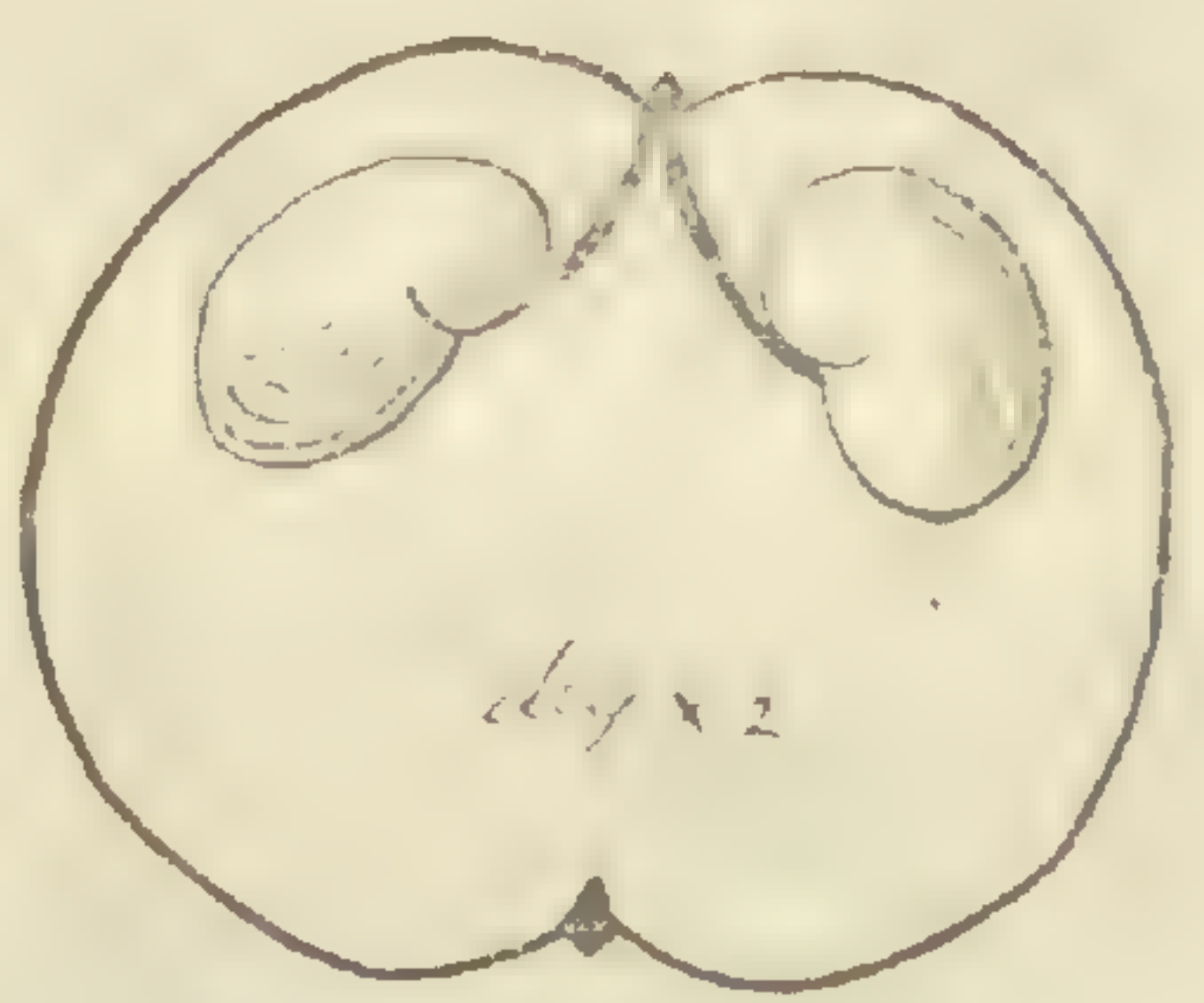
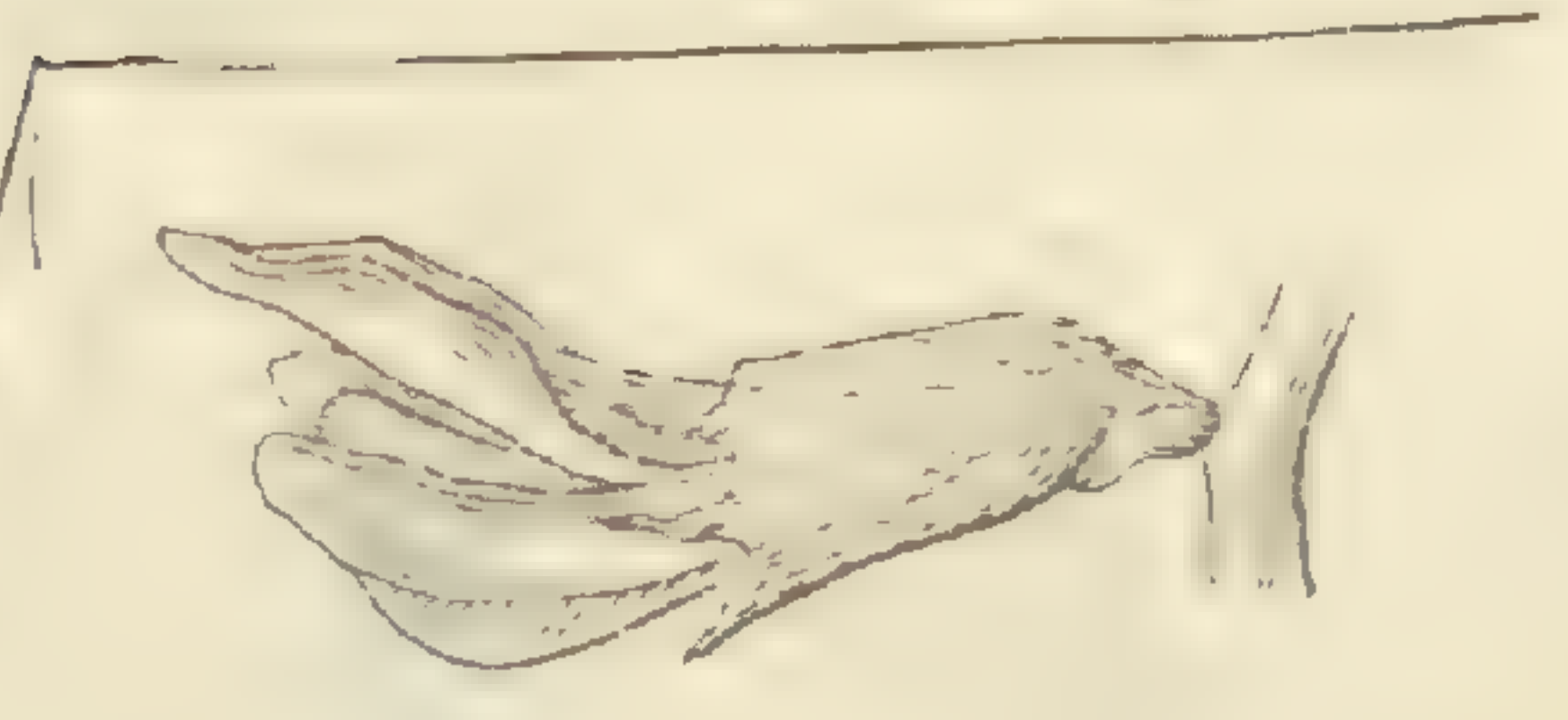
75



fruit x2

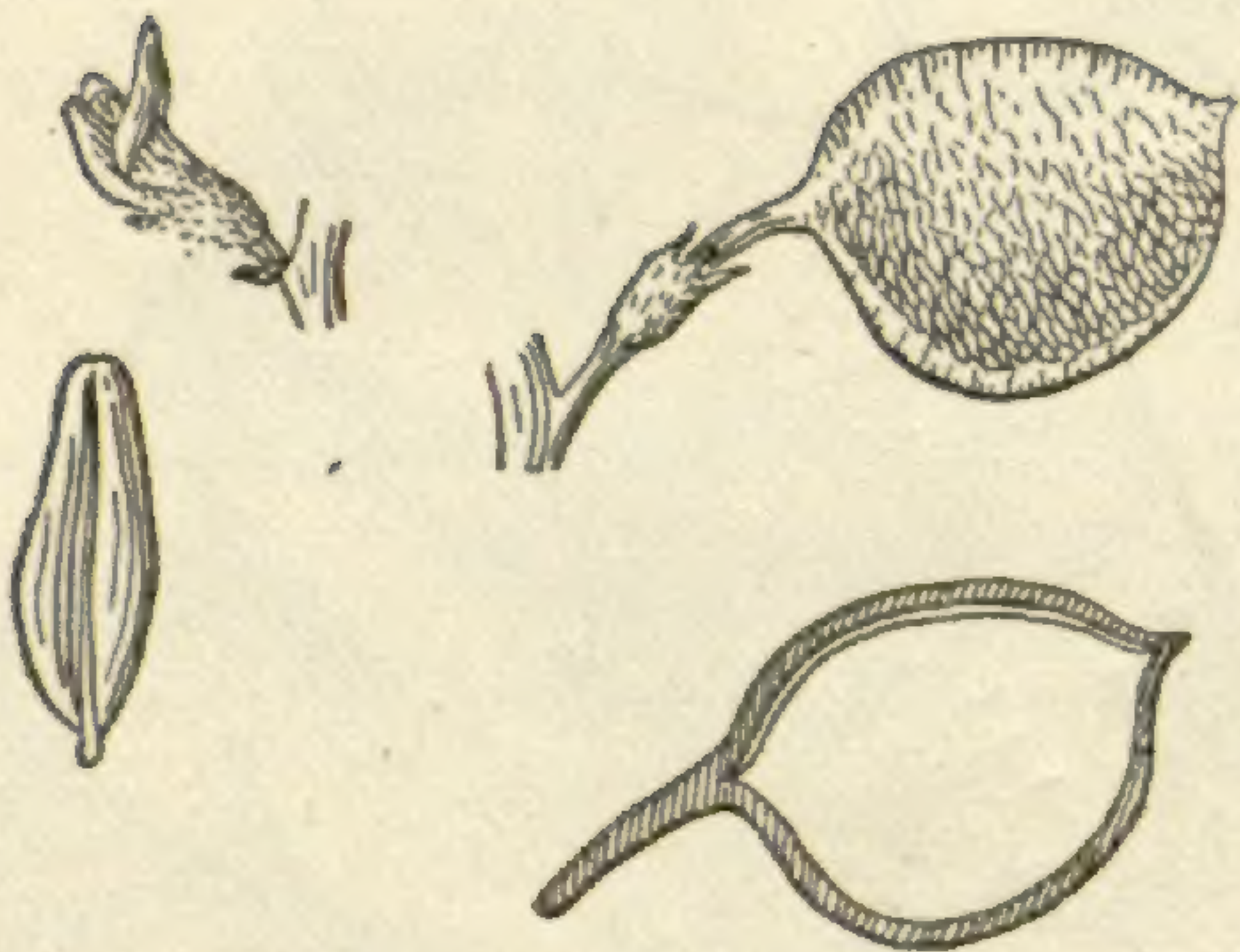


110 aclepladoides

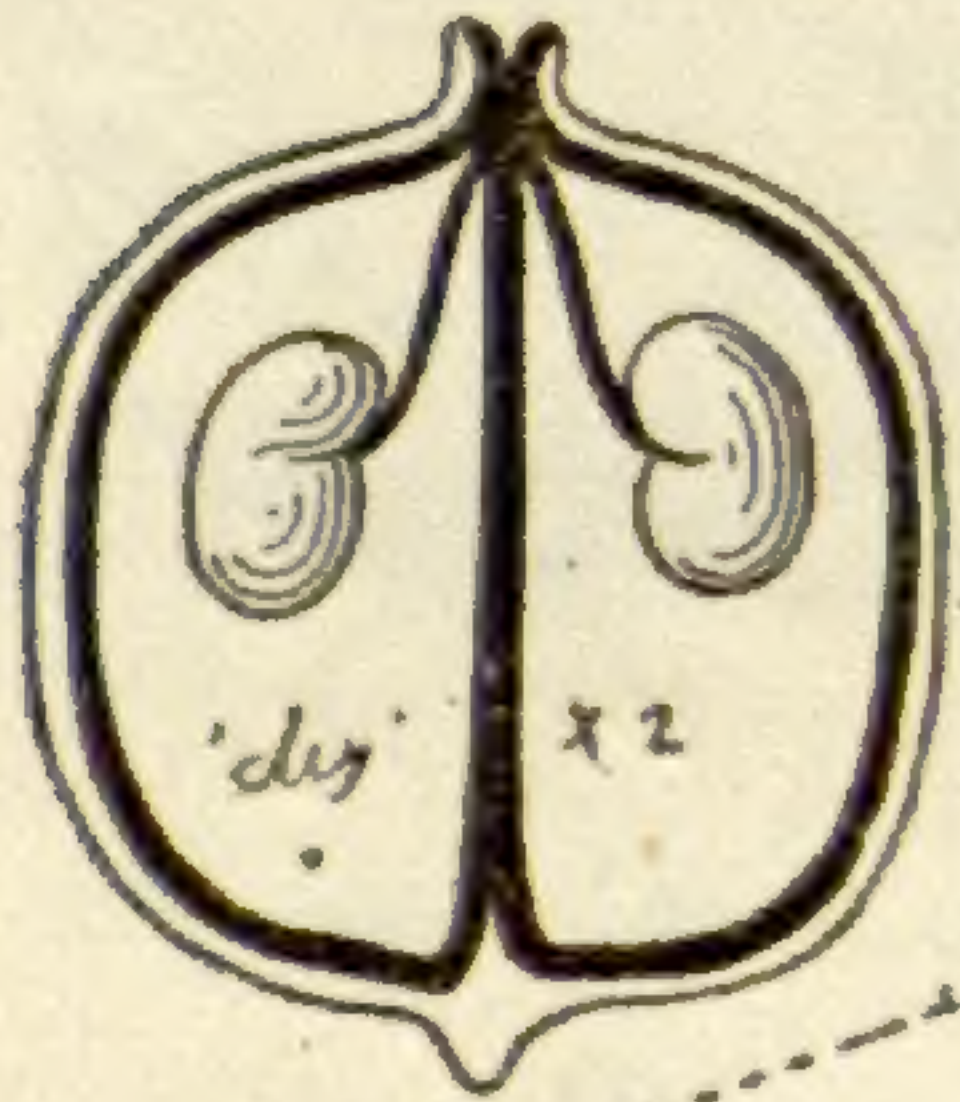


dry x2

115 anbulosa



125 *acridens* Var. *Hendersonii*



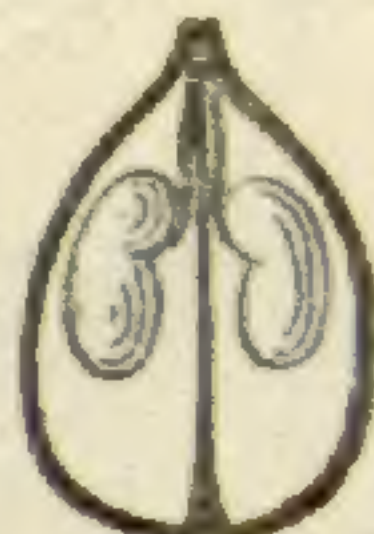
humiformis



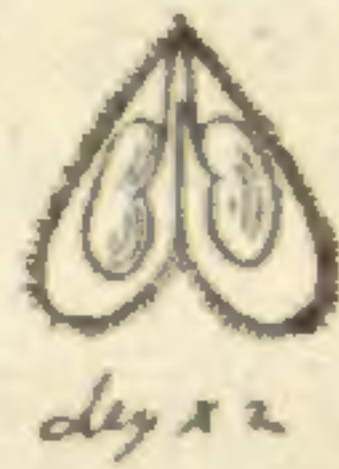
des x 2



12. *acridens*



des x 2



des x 2

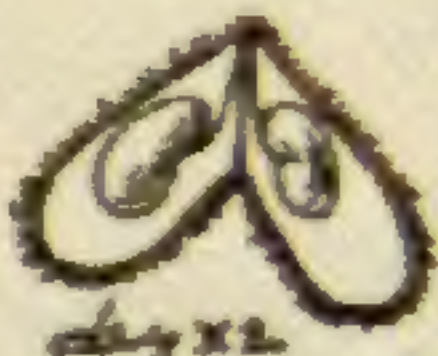
130 *nitida*



adulgens



Saxmannii



des x 2

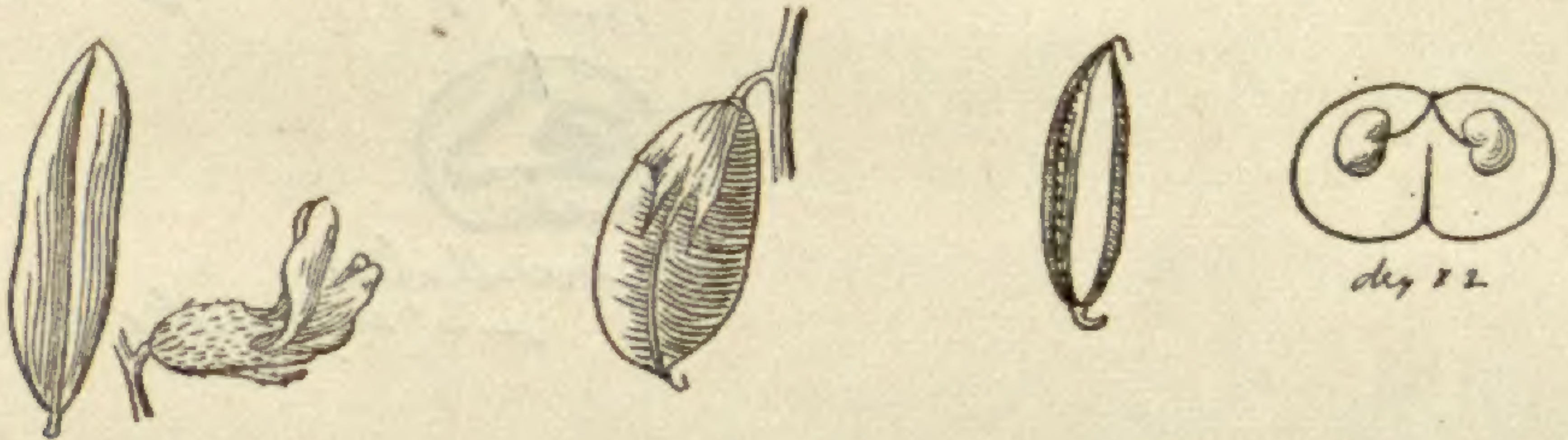
128 *Andina*



Rusbyi



143 strigulosus Var. brevidentatus



101 reptans

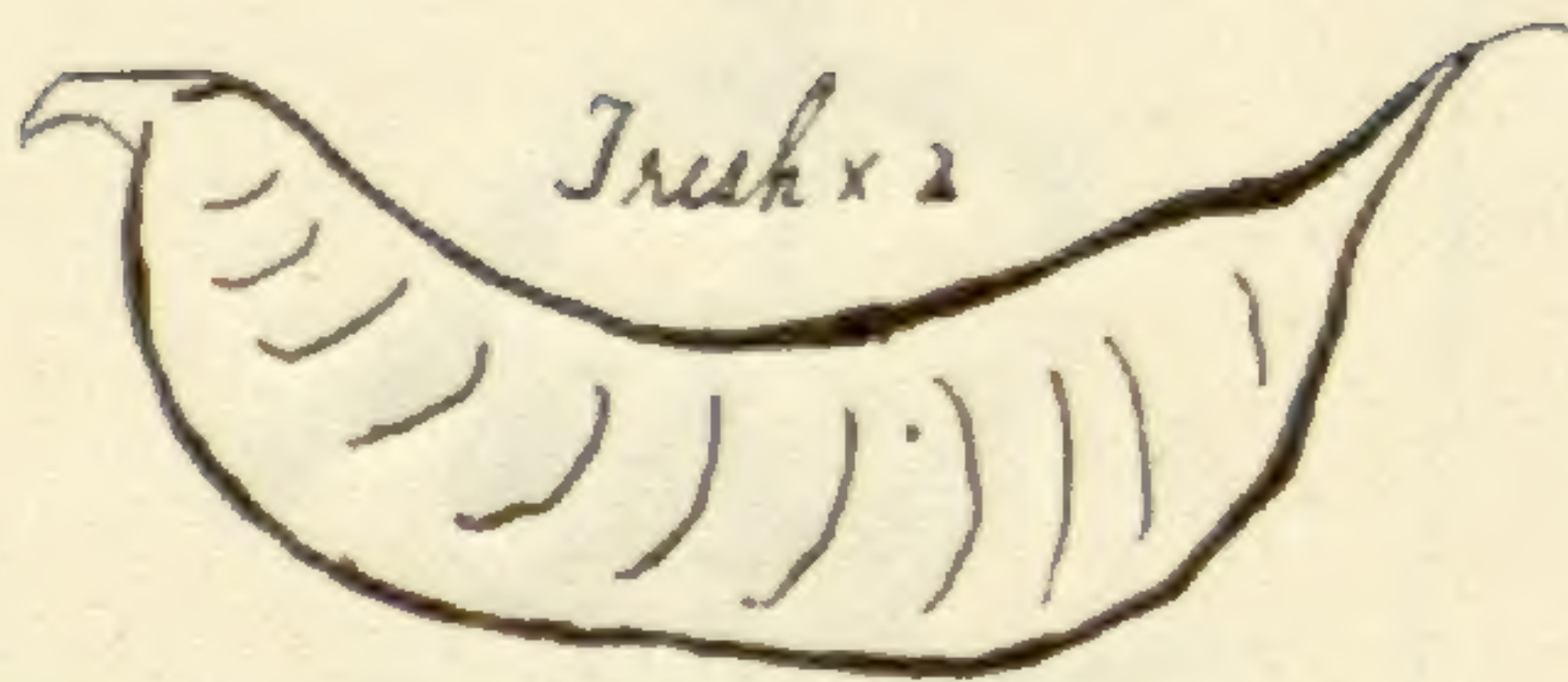


7 Californicus

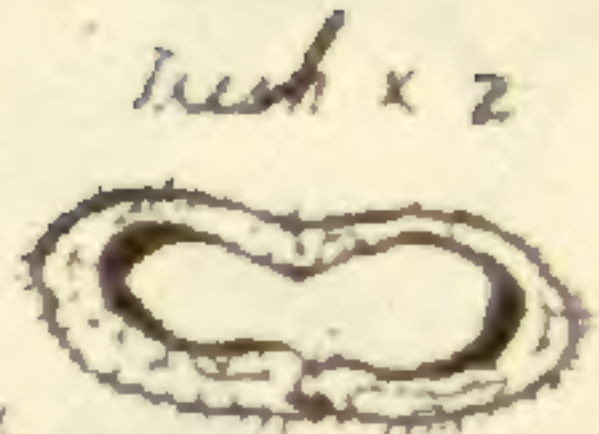


8 inversus

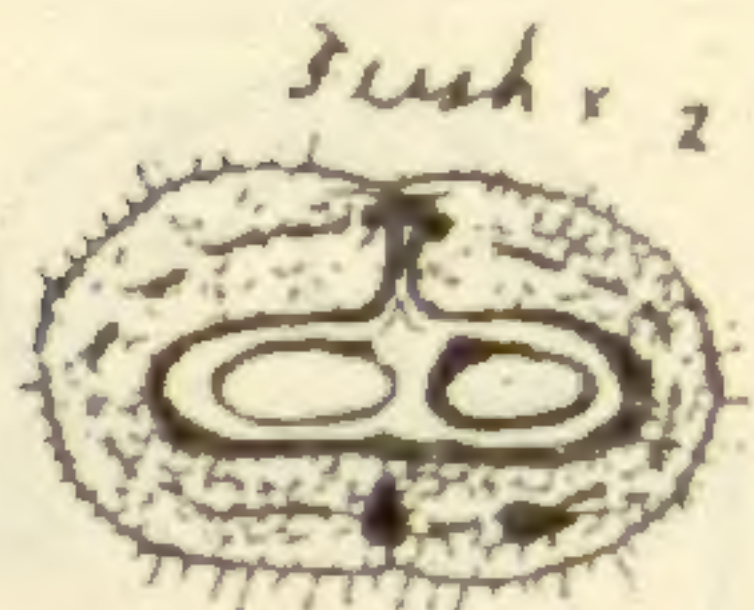
(78)



168. *Zionis*



168 *Zionis*



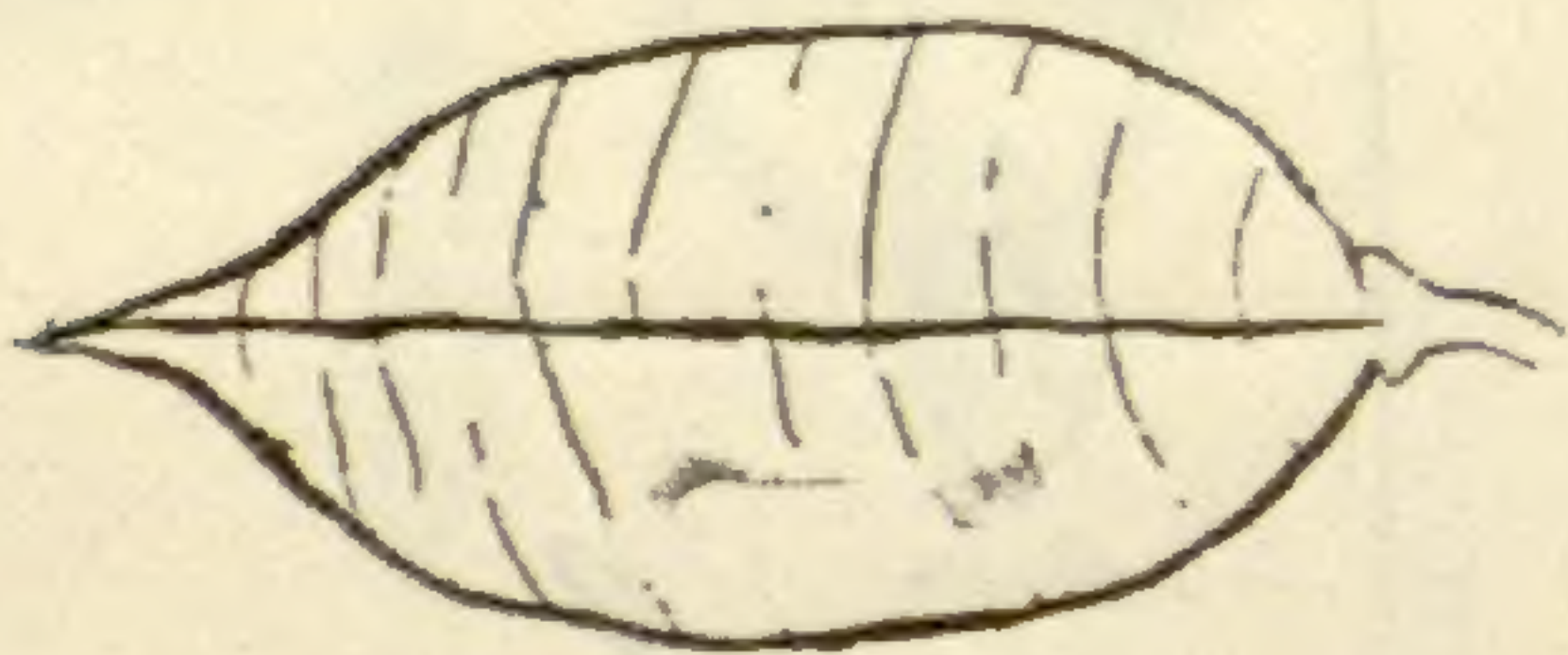
168 *Zionis*

Fresh x 2



109 *brasilensis*
var. *apterocelis*

Fresh



117

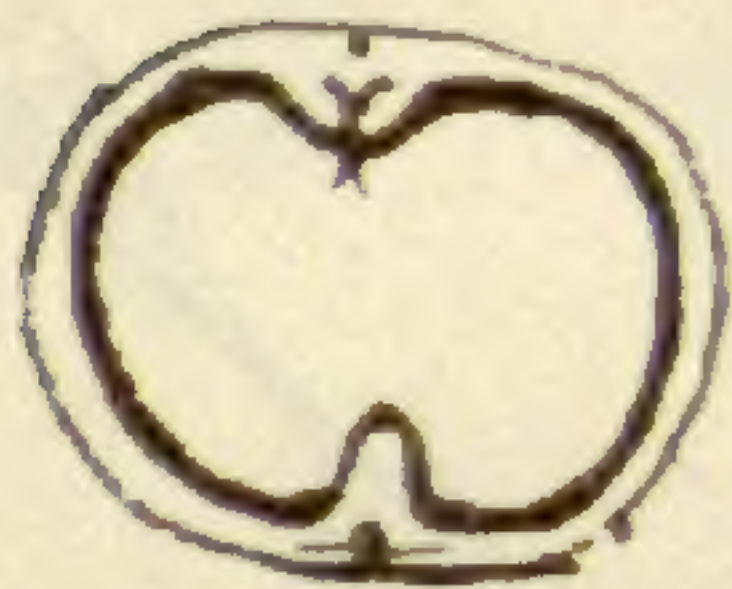
Fresh



117

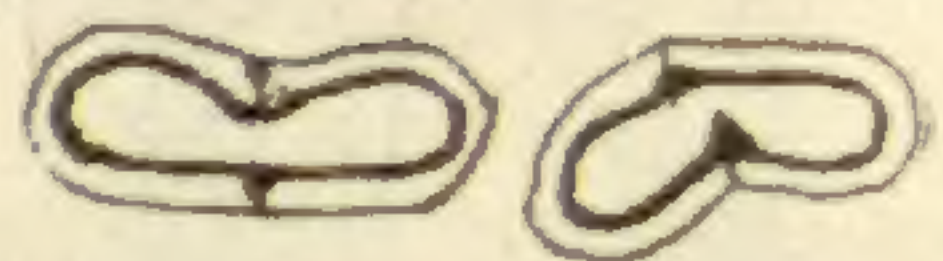
117
Pattersoni
var. *proebus*

Fresh



117

Fresh



122 *Comensis*

Botanical Publications of Marcus E. Jones.

- Excursion Botanique, out of print.
Ferns of the West, 30 pp. \$.50.
Contributions to Western Botany No. 1, Zoe II 12-17
Contributions to Western Botany No. 2, Zoe II 336-252.
\$.25.
Contributions to Western Botany No. 3, Zoe III 283-309.
\$.25.
Contributions to Western Botany No. 4, Zoe IV 22-54. \$.50.
Contributions to Western Botany No. 5, Zoe IV 254-282.
\$.50.
Contributions to Western Botany No. 6, Zoe IV 366-369.
\$.25.
Systematic Botany, Zoe IV 374-379.
Contributions to Western Botany No. 7, Proc. Cal. Acad. Ser.
2 Vol. V 611-734. \$1.50.
Contributions to Western Botany No. 8 pp. 43. \$.50.
Contributions to Western Botany No. 9, Zoe V 41-57. \$.25.
Contributions to Western Botany No. 10 pp. 90 and 17 plates.
Rev. Allium and Nyctaginaceæ. \$1.50.
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